RAILROAD GAZETTE

FRIDAY, MARCH 20, 1903.

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The office of the Railroad Gazette is now at 83 FULTON STREET, at the corner of Gold Street, east of Broadway.

Train Accident Record—Correction.

The collision reported in the *Railroad Gazette* of February 27 as occurring January 23 on the Chesapeake & Ohio at Louisville, Ky., happened at Limeville, Ky.; and instead of being a severe collision, causing one fatal injury and nine others of a less serious character, it was a very slight accident and caused no injury except to one trainman, who jumped off, and this one was of small consequence. The damage to cars and engines was insignificant.

Contributions

Automatic Stops.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I have read an article published in your issue of March 6 entitled "An Expert's Experience With Automatic Stops." Mr. Elliott quotes figures to show that brakes must be applied 3,000 ft. in advance of the point at which it is necessary to stop. The safety stop does not change this condition in the least, but insures the application of the brakes at the proper time. In regard to the loss of time by the wasting of air when the brakes are applied by the safety stop: If the engineer is alive and competent to act he will place his valve on lap and not lose the main reservoir pressure; if he is unable to do this the loss of air is of no importance, as the train could not proceed until another engineer was secured.

Mr. Elliott complains that to provide an overlap would increase the number of signals and thereby increase the expense; but the lives of the traveling public should not be jeopardized for a few thousand dollars. The safety stop signal would cost the same as the electric semaphore home signal, and by introducing the overlap a substantial balance would be found in favor of the safety stop signals. The cost of maintenance, which deserves closer scrutiny than does the first cost, would add materially to the balance in favor of safety stop signals, because the safety stop signal furnishes its own power and no expense is required for batteries to run motors.

Mr. Elliott complains that to adopt an overlap and use the stop would change the practice of the whole country, the practice being to use a distant signal and no overlap; but the many accidents constantly occurring prove the practice wrong, and the sooner it is changed the better. A distant signal is simply an afterthought, brought forward in an effort to make the visual signal do what 30 years of experience has proved its inability to do.

Mr. Elliott says the automatic is a permissive signal and the safety stop would not change this. The safety stop certainly would change it, and it ought to be changed; permissive signaling should not be countenanced on any first-class road. Signaling apparatus can be, and is being, made sufficiently reliable so that no serious delay will be felt by compelling a train to flag through a section after waiting the prescribed time and the signal does not clear. Mr. Elliott says an emergency application of the brakes is made when the train passes the signal. In actual practice nothing of the kind occurs. If a train pulls up to a signal and stops it then starts past the signal, moving very slowly, and the automatic application of the brakes is made only while the machine on the engine is passing a fixed point 30 in. in length; the fireman steps down on the ground, holds his thumb on the release plug of the valve and while the valve is opened it immediately closes and practically no air is lost by the operation.

At the tests made on the C., M. & St. P. Railroad Oct. 16, 1902, before S. M. Felton, H. R. Williams, W. H. Elliott, and others, all of the above mentioned criticisms were brought up and answered. Six months service showed that the fixtures could not be carried away or injured by something dragging from the train. The valve on the engine is a mechanical contrivance of substantial design as reliable as the air-brake.

Some one may say that the use of the stop will cause the engineer to be careless, but in practice the stop establishes in the minds of the men a wholesome respect for the signals, and they are very careful not to disregard them. It is true that in running double headers the valve on the rear engine must be cut out. It is also common practice to cut the engineer's brake valve out on the rear engine, giving the man on the forward engine full control of the brakes. If discipline will make him cut in his valve at the end of the run, why will it not make him cut in the stop valve with equal certainty? It is also true that running the wrong way on double track the valve must be cut out, so is the entire signal system cut out whatever that system may be. The cut-out valve is sealed. To cut the stop out, the seal must be broken; if broken, the engineer must report why.

B. C. ROWELL.

Water Purification on the Rio Grande & Eagle Pass.

New York, March 10, 1903.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The article under the caption of "Purifying Water for Locomotive Boilers" in the *Railroad Gazette* of Feb. 27, 1903, in which is described the apparatus adopted by the Chicago & North Western, has greatly interested me as one familiar with the softening and purification of water for locomotive purposes on the Rio Grande & Eagle Pass, where a somewhat different device is used to accomplish the desired result. The plants referred to are of the "continuous" type and in a great many ways seem to me superior to those adopted by the North Western, if the descriptions and accompanying cuts do justice to Mr. Davidson's system.

One of the principal objections to an apparatus such as his, is its great size. Authorities on the subject of purification by systems wherein the settling of the precipitate takes place in the same tank in which the mixing is carried on, agree that it usually requires in the neighborhood of six hours to effect what may be termed approximate subsidence; even when it is generally customary to use a filter to completely clarify the water.

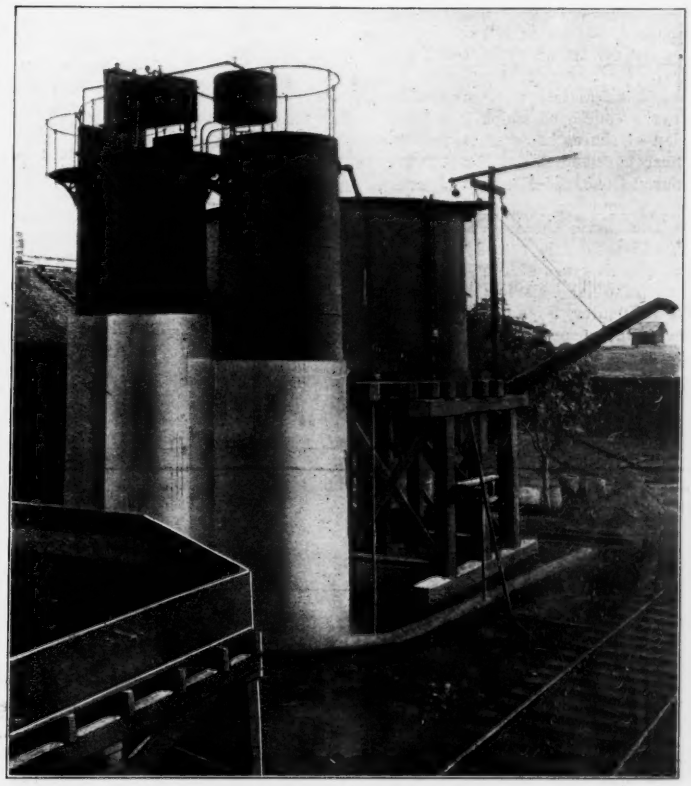
It would appear from the cut that the tanks described are located on the ground. If the existing supply at any water station comes to the machine by gravity, city pressure, or other means, even then the boiler and pump shown in the cut (but unnecessary with a machine of the "continuous" type) must be included as a part of the equipment, since they are an essential portion of the purifying system. If, on the other hand, a pumping plant must be maintained to lift the raw water from a well or other source, the objection holds that, in this process, all the water must pass through the pump twice (in its raw state and after treatment) before it reaches the storage tank. If, however, the elevation of the whole apparatus be contemplated it is evident that a foundation of sufficient size to support the tanks to hold a maximum of 12 hours' supply of water is a necessity. It is obvious that it is useless to elevate the tanks at all unless they be raised high enough to be completely emptied into the storage tank by gravity.

The "circulation" for the purpose of stirring the water under treatment for only 15 minutes is not the best method for insuring the most thorough mixing, which, of course, is essential to complete reaction. Apparently Mr. Davidson tries to compensate for this inefficient mixing by providing tanks of large capacity and allowing considerable time for reaction. But it must be evident that unless the chemicals are actually brought into contact with the calcium and magnesium salts, which they are to precipitate, reaction cannot take place.

It appears further that the device is very wasteful of the water; according to the figures presented more than 22 per cent. of the total amount of water treated is wasted. Let us assume that the water be bought from some water company as is frequently the case at, say, 13 cents per thousand gallons; that the cost of softening be 5 cents; then the total cost of water, aside from the interest and depreciation on the softening plant is 18 cents per thousand gallons. If 17,000 gallons out of a total of 77,000 gallons are wasted daily it is easy to see that in preparing for use this 60,000 gallons of water, $3.06 per day, or more than $1,000 per year, is literally thrown away. This, of course, does not take into account the operating cost nor the interest and depreciation chargeable to the pumping plant which is a necessary part of such an apparatus as described in your article, but otherwise superfluous.

On the National Railroad of Mexico at Rodriguez there is a "continuous" machine made of tower-like tanks from the top of which the water flows by gravity into the storage tank. In this case no high foundation is required, which, of course, is an advantage. It occurs to me, however, that on account of the great height of the settling tank, the rate of flow upward (against which the precipitate is supposed to settle) must be quite rapid. If the settling tank were differently proportioned—decreasing the height and increasing the diameter—it is evident that the rate of flow upward would be lessened, and that the settling area would be increased, thereby insuring much more efficient settling.

To the machine at Laredo, Texas, of which I send a view, the above noted objections do not apply. In the first place, the machine is not of great size; so that it is perfectly feasible to elevate it sufficiently for the water to be handled by one pumping, and with but slight loss of head, from the source to the storage tank. With city pressure, or gravity supply, no pumping is required. The machine consists primarily of three tanks: the one at the left being for the continuous solution and supply of calcium hydrate as clear lime water. The tank occupying the central position is for the purpose of mixing the chemicals with the water. This tank is provided with a system of stirrers driven by a water-wheel, a part of the machine, and is of such size that the water under treatment for a period of at least half an hour is continuously agitated. When the water leaves this tank to enter the settling tank, the largest of the three, it is soft, but contains in suspension the precipitate of the calcium and magnesium salts formerly held in solution, in addition to any material which may have been carried in suspension as mud or organic matter. On account of the fact that the water has been thoroughly stirred in the reaction tank, the precipitates are in such condition as to settle very readily. The clear water passes upward and through a loose wood fiber filter to the outlet, as clear water free from all suspended matter; the whole operation requires about two and one-half hours from the time the water enters the wheel box until it passes from the outlet as clear soft water. To my knowledge only 3 per cent. of the total amount of water treated daily is used in washing the filter and disposing of the accumulated precipitate.



Water Softener at Laredo, Texas.

A. C. CHRISTENSEN, *M. Am. Soc. M. E.*

English Capital for the Tokyo Street Railroad.

Tokyo, Japan, Jan. 23, 1903.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Sir Malcolm MacEacharn, of Messrs. McIlwraith, MacEacharn & Co., of London and Melbourne, acting on behalf of a British syndicate, has almost concluded an arrangement with the electric street railroad of Tokyo in virtue of which the British syndicate will supply the Japanese company with the capital it badly needs. This company was originally started with the small capital of 800,000 yen (about $400,000), but a proposal to greatly enlarge its field of operations necessitated the raising of at least six million yen ($3,000,000), and as the additional sum could not be obtained in Japan, steps were taken largely on the initiative of Mr. Kondo, Presi-

dent of the Nippon Yusen Kaisha, to raise the money abroad. It is as a result of these steps that Sir Malcolm MacEacharn is now in this country. The following is a draft of the agreement which that gentleman has drawn up, but it may of course be somewhat modified before it is signed by the representatives of both parties:

(1.) The share capital shall be equally divided between British and Japanese.

(2.) The staff of directors and auditors shall consist of an equal number of British and Japanese.

(3.) The chief engineer on the work of construction will be British, and he will be employed for two years after the conclusion of the construction work.

(4.) The paid-up capital shall be kept at the smallest amount possible at the beginning of the work, and more money shall be afterwards obtained by means of debentures to be issued at the rate of 6 per cent. per annum.

(5.) In order to effect the flotation of the debentures, a syndicate shall be formed in London.

(6.) This syndicate shall supply the railroad company with the material it needs to purchase abroad, and may contract for other companies also.

(7.) The net profits of the syndicate, which are to include the commission for the supply of stock and for contracts and the premium on the debentures, shall be appropriated for the payment of dividends.

(8.) This syndicate shall be formed by the shareholders of the Tokyo electric railroad company, and its directors shall belong to that company.

(9.) The instalments of the syndicate's capital shall be paid in shares of the street railroad company.

(10.) When the agreement has become operative, half the subscribed capital of the Tokyo electric railroad company shall be ceded to the British capitalists at a reasonable rate of interest besides the paid-up capital.

The only difficulty in Sir Malcolm MacEacharn's way is the suspicion with which a small, conservative section of the Japanese regard any association of their countrymen with foreigners for business purposes. On the 16th inst., for example, the *Hochi*, a Tokyo newspaper, published an article on the negotiations above referred to, in the course of which it alluded to the foreign possession of shares in Japanese enterprises as an event of the most ominous description, and tried to make out that Baron Soné, the Minister of Communications, is "a seller of his country" because he encourages such negotiations.

The small, timid section of the public for which the *Hochi* speaks is afraid that wealthy foreign capitalists will, if they are allowed to have anything to do with the control of the electric line, act against the interests of their poorer Japanese fellow shareholders by setting aside large sums for reserves, and thus diminishing the rate of dividend.

The very idea of this horrifies the Japanese shareholders more than anything else, for they are accustomed to put hardly anything at all in their reserve funds, and their railroads and other public works suffer considerably in consequence.

A funny instance of this occurred here some time ago. An American syndicate was going to put some money in an electric line in another part of Japan, when suddenly the Japanese with whom the syndicate was negotiating learned the dreadful news that the American capitalists who are associated with Messrs. Murai Brothers, the great Japanese firm of tobacconists and cigarette makers, had insisted on that firm putting 40 per cent. of their profit into the reserve fund. The electric railroad people were so frightened at the idea that the same thing might happen to themselves that they broke off negotiations at once. It never occurred to them to first ascertain if the story was not a canard.

But what the Japanese are most afraid of is that, with unlimited capital to back them, the foreigners may ultimately become too powerful in Japan. In the case of the Tokyo electric railroad, however, none of these fears need be entertained, for no foreign shareholder will be so disinterested as to propose setting apart as a reserve fund more than the 10 per cent. of the net profit required by the Home Office, and, even if the whole control of the concern passes into the hands of foreign shareholders, no great harm will have been done, since the whole plant, etc., is to revert to the Municipality after the Anglo-Japanese company has run the business for 50 years.

There can be no doubt that an electric line should pay well in Tokyo, for the Japanese are very fond of using railroads and tram cars: and even the present antiquated horse-car service pays an annual dividend of about 25 per cent. The possibility of some misunderstanding with the Japanese must always, however, be taken into account. There is the instance of the Osaka Gas Works. These works are owned by a Japanese company which got a charter some years ago authorizing it to lay its pipes all over Osaka. It had not money enough to do this to as large an extent as it desired, and when a foreign capitalist, a Mr. Brady, of New York, was asked to supply the necessary capital, the Osaka Municipality waited till the agreement was signed and then got up an agitation the object of which was to make the gas company contribute something to the city. The company's charter said nothing about any such contribution, but the Mayor of Osaka snapped his fingers at the charter (which had been given by the Home Office), and declared that he would either have the money or start an opposition business. He declared, moreover, that it was disgraceful for the company not to give the city any money after it had got so much from Mr. Brady, and the whole Japanese people and press, with the exception of two or three newspapers and two or three members of the Osaka Municipality (and these latter were charitably assumed by their fellow members to have been bought by the foreign capitalist)—saw nothing out of the way in this worthy Mayor's request.

FRANCIS M'CULLAGH.

Railroad Shops.

BY WALTER G. BERG.*

II.

General Tendency in Grouping and Constructing Shop Buildings.—In large railroad general repair shops or main repair shops of a large road, the general tendency is to group the several departments and then to concentrate the principal sub-departments or special branches of work belonging to each group in one large building or in a series of closely connected buildings. There are certain classes of work common to more than one department and the special buildings for these should be as convenient as possible to the department groups they serve. The storehouse and power plant should receive a central location.

The sub-departments in each group should be arranged and placed so as to reduce unproductive travel of men and materials, and also to follow, as far as practicable, the sequence of the main operations from beginning to finish. This cannot be carried to as fine a point in repair shops as in contract shops. In the latter all movements are towards the assembled car or piece of machinery, while in repair shops the movements are in both directions, from the dismantled engine or car to the various sub-departments and then back to be fitted into place.

Owing to the weight and bulk of the shop output, it is evident that one-story structures are preferred throughout, although certain small work and the storage of light materials can be placed in upper stories. The tendency is towards large one-story buildings with the sub-departments in one building, and in many cases with imaginary division lines only.

The principal points to consider in laying out a shop building are:

1. Locate the various sub-departments in proper relation to each other so as to avoid unproductive travel of men and material.

2. Establish the proportionate space required for each sub-department so as to correspond to the total shop output.

3. Provide proper communication and transfer methods between the various sub-departments and the entire shop system, yard, storehouse, etc.

4. Feasibility of overflow from one sub-department to another so as to make the sub-division elastic and capable of accommodating changed conditions in the future, or correct errors in the original proportioning of space.

5. Ample free floor space around machines and pits to give greater freedom in working and chance to store dismantled or new parts, material waiting to be worked up, or finished material.

6. Ample passageways and ease of supervision and observation of the various working forces and operations.

7. Ample and uniform lighting, day or night, and avoidance of shadows.

8. Efficient heating and good ventilation.

9. Proper sanitary appliances, sewerage, toilets, lavatories, lockers, etc.

10. Water supply and fire protection service.

11. Selection of class of materials to suit the purposes of each building and such degree of fireproofing as deemed advisable.

12. The grouping of the buildings and class of construction should not conflict with fire insurance regulations.

13. The exterior of the buildings should present a neat and substantial appearance. Architectural embellishments purely for the sake of an assumed æsthetic effect are out of place in a manufacturing plant.

14. Selection and location of machinery, determination of class of power and method of driving.

15. Auxiliary features such as pneumatic power supply and appliances, hot water, testing plants, smoke removal at forges, locomotive testing pits, etc.

16. The buildings and principal facilities should be on the basis of the service requirements at the time of the completion of the shop system and with a reasonable allowance for the probable yearly increase of the equipment for a number of years thereafter, so that the question of further extensions would not have to be considered for a period of about 10 years.

17. Ample provision for possible future extensions of the plant.

In addition to the direct economy due to a well-designed shop and an up-to-date equipment, stress should be laid on the influences of a shop with ample facilities and space, well lighted, ventilated, heated, clean, etc., on the health, habits and disposition of the workmen.

As stated above, the tendency in railroad shop construction is to erect very large single-story buildings with few dividing walls. Such a building is proportionately cheaper than a number of smaller buildings covering the same total floor area, provided the roof spans are not excessive and column supports are introduced. The result gives a large airy shop with great freedom for observation and control of operations, and an elastic division of the sub-departments. The principal special structural features to take care of are the necessary disposition of the roof water, the arrangement of side windows and top lights, so as to give good and uniform light throughout the interior, and the heating. Otherwise there is nothing special or unusual. If electric power is used, the greatest freedom in locating and spacing machinery can be observed and distance is not a factor.

An objection is sometimes made to large shop buildings or the duplication of certain facilities (such as two erecting shops separated by a machine shop) that the supervision of the work is made more difficult than if the various sub-departments are grouped in separate buildings. This was thoroughly canvassed on a recent extensive trip to some of the principal shops of the country, and it became perfectly apparent that there is no serious objection on this score in very large shops. A number of large shops, notably manufacturing concerns, have actually introduced the so-called "unit-system" purposely, as one man cannot take charge of a large plant and it is well to have his assistants placed in charge of a certain unit of the plant. At the McCormick Reaper Works, Chicago, a foundry was recently built 1,200 ft. long, divided into three units or separate buildings 400 ft. long. At West Allis the Allis-Chalmers Works will have 12 wing buildings, each 575 ft. x 122 ft., all leading into the nearly one-half mile long main erecting shop, divided into four groups of three wings each. Each group will be in charge of a separate foreman with assistant foremen in each wing. Similarly the one-half mile long erecting shop and the one-half mile long foundry will be subdivided and placed in charge of separate men.

Layout of General Repair Shops.—There is no general rule that can be prescribed for the layout of general repair shops, excepting that for small shops in the nature of "division repair shops," even if classed on a small road as main repair shops, the preferred design is no doubt the system with one transfer table serving all departments. This system is very compact and well adapted for small shops. It does not seem to have been used in any shop layout with more than 15 locomotive erecting pits, indeed, most of the examples have from 10 to 15 locomotive pits, and the boiler shop, passenger and freight car departments are correspondingly small.

For large general repair shops the preferred system is to group separately the buildings and facilities belonging to each of the three principal classes of work, viz.: locomotives, passenger cars and freight cars. Local conditions and individual opinions control the layouts. In some cases all three groups are laid out on the longitudinal plan, in other cases they are all concentrated on separate transfer tables. The bulk of the modern layouts tend towards differentiation of the cross and longitudinal systems according to the best results to be obtained for the work in each department and the layout of the available land.

It can be stated, however, that for large shop layouts the preferred systems are: For light freight car repairs, long parallel tracks connected at each end to yard leaders. For heavy freight car repairs, longitudinal buildings with tracks extending some distance each way from the building and connected up at each end to yard leaders; where the plant is large, an auxiliary transfer table at the shop is introduced for lateral movement. For passenger car repairs, transfer table service. For locomotive erecting shops, cross tracks with heavy traversing crane for lifting locomotives over each other; also the system of longitudinal tracks. The heaviest modern plants, however, tend towards the system of cross locomotive erecting shop with heavy traversing cranes for lifting engines over each other.

Grouping of Departments in a Locomotive Repair Shop.—The principal departments for locomotive repairs are the erecting shop, machine shop and boiler shop. These are usually together and form the main locomotive shop.

Further, there has to be provided a blacksmith shop. These four shops, viz.: erecting shop, machine shop, boiler shop and blacksmith shop, form the main sub-departments.

In addition there are the following shops, or sub-departments, viz.: Wheel shop, tank shop, hammer shop for heavy forging, flange shop, flue shop, which, in some cases, are provided for in the boiler and blacksmith shop, and in other cases are in separate buildings.

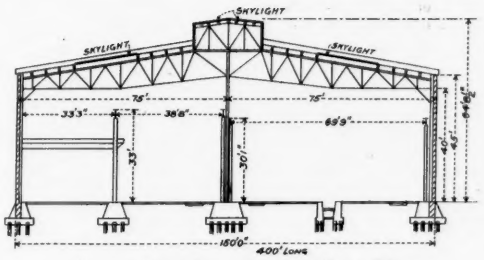
Provision also has to be made for iron and castings storage sheds, scrap bins or scrap yard, storehouse, tool room, carpenter shop, pattern shop, etc. Also offices, power plant, oil house, etc., usually provided for joint use of car and locomotive departments. In some cases a special small paint shop is provided for the locomotive department. In special cases, foundries for iron, brass or copper are added.

It is desirable to have the roundhouse close to and connected by a track with the locomotive shop, so that light engine repairs in the roundhouse can be made from the main shop or locomotives easily transferred from the roundhouse to shops.

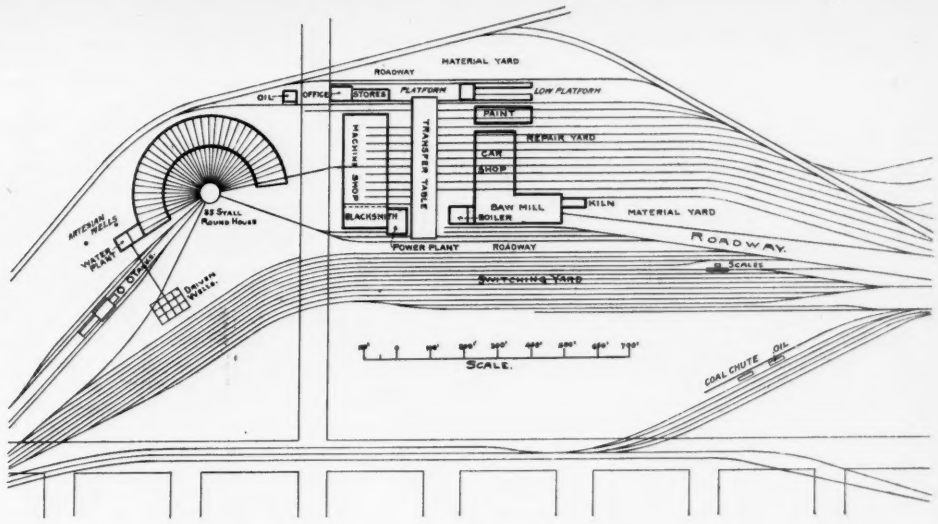
The machine shop is practically in all designs in the same building as the erecting shop, and is placed parallel to the pits in a longitudinal shop or parallel to the row of pits in a cross shop. There are few variations from this rule.

The boiler shop in recent large installations is part of the main locomotive shop and arranged so that boilers after being un-wheeled can be readily transferred to the boiler shop, either by overhead cranes or on push cars. At transfer table layouts the boiler shop is frequently

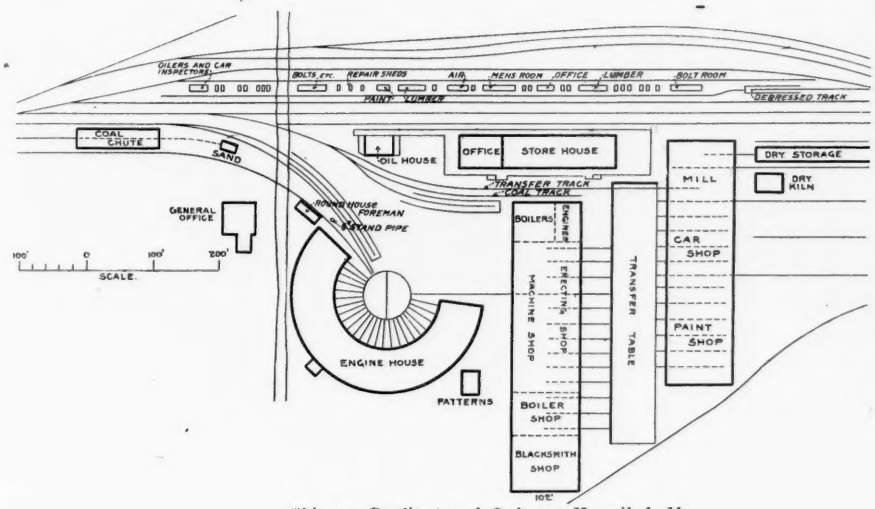
*Chief Engineer of the Lehigh Valley.



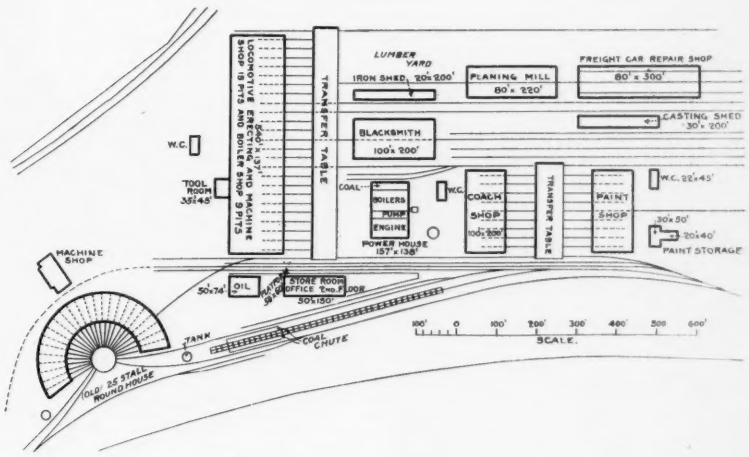
Locomotive Shop—Oregon Short Line.



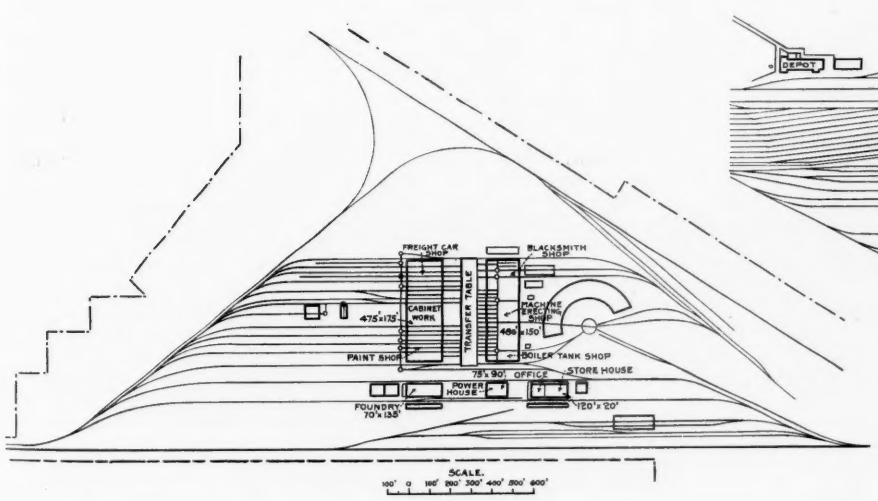
Colorado & Southern—Denver, Colo.



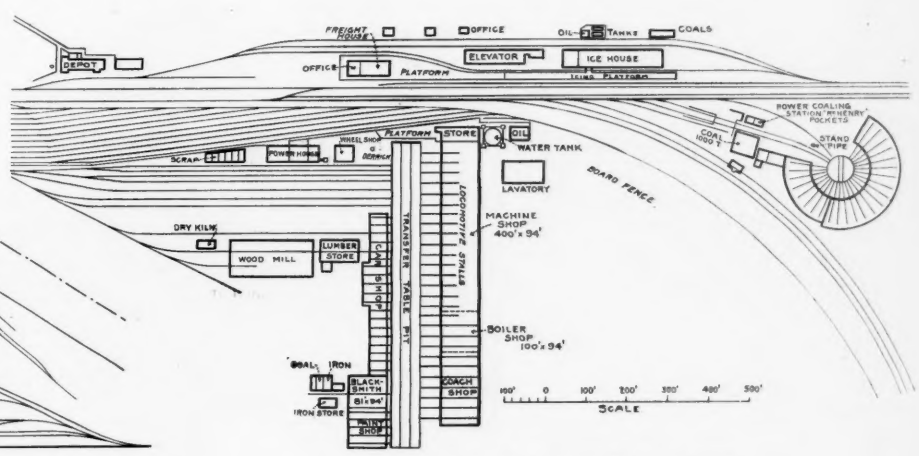
Chicago, Burlington & Quincy—Hannibal, Mo.



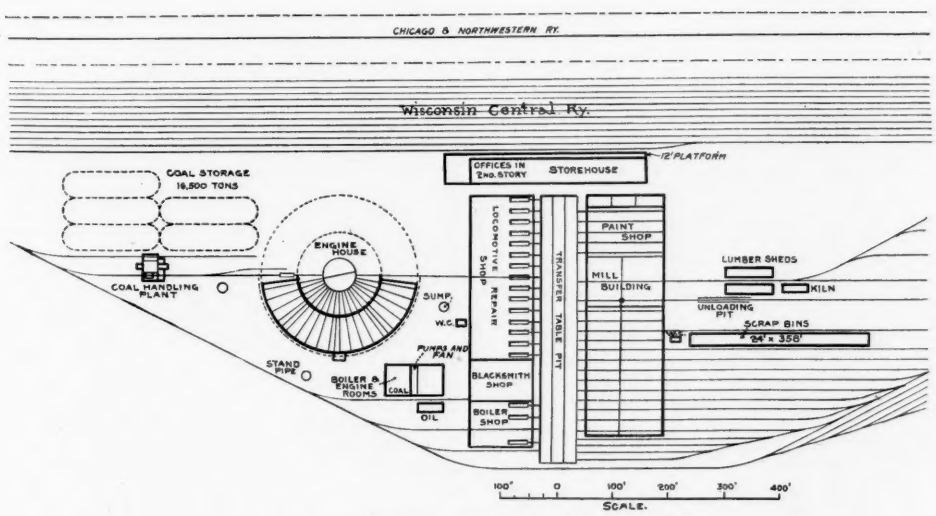
St. Louis, Iron Mountain & Southern—Baring Cross, Ark.



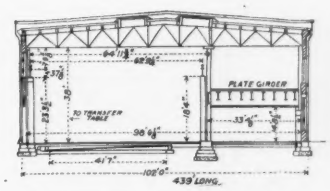
Oregon Short Line—Pocatello, Oregon.



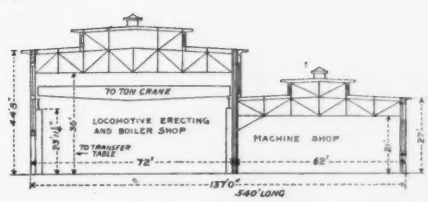
Chicago Great Western—Oelwein, Iowa.



Wisconsin Central—Fond du Lac, Wis.



Locomotive Shop—C., B. & Q.



Locomotive Shop—St. L., I. M. & S.

General Repair Shops with One Transfer Table for all Departments.

on the opposite side of the table from the main locomotive shop.

The disposition and handling of the wheels, after being removed from the locomotive, on their way to and from the machine shop is one of the most important points to consider.

The storage for dismantled parts of the engine has to be provided. This is sometimes done on racks between the pits, in outside yards, in yards under cover, or in floor pits.

No particular rule can be given as to the proper location of the blacksmith shop and minor buildings of the plant, as their location is usually governed by local conditions, but they should be placed with reference to the least handling of materials and avoidance of unproductive travel.

Longitudinal vs. Cross Erecting Shops.—The first requisite for an intelligent analysis of the subject is to settle what class or size shop is under consideration. It should be remembered that a cross shop, owing to the development of the overhead crane, does not necessarily mean that a transfer table must be used, as heavy overhead traversing cranes for transferring engines inside the buildings are being extensively used at large plants.

In a division repair shop, or general repair shop of a small road, there seems no question but that a transfer table (especially in southern sections of the country), should be used in connection with a cross erecting shop as the system is compact. The best modern practice provides a comparatively light overhead crane in the erecting shop for assisting in lifting heavy parts and transferring wheels. In some cases the crane is made heavy enough to transfer boilers and thus eliminates jacking, special lifting staging, drop pits or trucking of boilers.

In small general repair shop layouts the use of a transfer table for the erecting shop becomes a practical necessity and its use at such plants is not a leading argument for or against a transfer table in cross shops, as the plant is probably too small to warrant a heavy overhead crane for lifting engines over each other or a longitudinal building not in harmony with the whole layout. These transfer table cross shops are usually small, as otherwise the one transfer table would be too heavily taxed, as it has to serve all the departments of the plant.

Reference to a number of old and new general repair shops shows that the largest erecting shops, where one table serves all departments, have only 15 erecting pits, and, where one table is used only for the locomotive department, the number of erecting pits is limited to 25, excepting the New York Central shops at Depew, where there are 48.

The only arguments that can be drawn from recent current practice in favor of a transfer table for large erecting shops are found in the fact that at the Burnside shops of the Illinois Central at Chicago a new plant was laid out with 25 pits in 1892, with provision for extension to a possible total of about 35 pits; that a new plant at St. Paul with 25 pits was built in 1902; and, further, that at Depew, built in 1892, there are 48 pits.

The layout at Depew differs from the others in that there are two erecting shops, one on each side of the table with 24 pits each, and there is an additional transfer table for the boiler house service, whereas at all other shops considered the one transfer table serves erecting and boiler shops.

A transfer table, serving only a locomotive shop, is limited to about 25 erecting pits, with the possible extension to 35 pits at Burnside, and the special layout for 48 pits at Depew with the auxiliary table for the boiler shop.

This analysis of transfer table service at locomotive shops has been deemed advisable so as to clear the ground for a free discussion of longitudinal or cross shops for *large* plants. Advocates of the longitudinal layout generally present the objectionable feature of transfer tables as an argument against cross shops, but the above analysis indicates that transfer tables are used more generally in comparatively small plants.

The objectionable features connected with transfer tables are that they take up valuable space, introduce a pit or obstruction between the various buildings, fill up with snow in winter in northern climates unless covered over, require many large doors in the side of the building, necessitate constant repairs, cut off light, produce drafts and make the building harder to heat in winter.

The advantages of transfer tables for small shops are that they offer a very compact and neat layout and a handy and economical method of connecting all departments without lost space in track approaches and yard developments. They further allow a low building. Cross tracks in the main erecting shop allow the machine shop to be directly in the rear of the pits, which is undoubtedly the preferred position.

The tendency is to introduce a light traveling crane in cross erecting shops. In some cases the crane is made heavy enough to serve in lifting and transferring boilers. The longitudinal shop advocates point to the expense of the combination of crane and transfer table and consider it preferable to have two cranes in the house and no transfer table. In both cases two men are required. The decision will depend on the general conditions and particularly on whether the transfer table is the controlling element of the entire shop layout. The main question at issue for *large* erecting shops is longitudinal shop vs. cross shop with heavy traversing crane. In other words, the above analysis has shown that transfer tables are evidently used mainly for small plants.

In building a shop the main feature is to design it so as to offer the cheapest possible operating methods and to get engines out of the shop quickly. This is more important than comparatively petty questions as to whether one or the other system gives less height of building, or occupies less floor space, etc. In other words, the problem must be sized up from the practical operating standpoint and not absolutely as a question of first cost. It is more important to have first-class arrangements for stripping engines quickly, space for taking out flues, caring for dismantled parts, transferring boilers and wheels back and forth quickly, clear passageways, freedom of transfer to and from the machine shop, than to save a comparatively insignificant sum at the start. The watchword of to-day is not only economy but speed in returning equipment to the road for service.

The advocates of longitudinal shops figure on floor space per engine. In doing so they count the middle communication track as covered with engines, which is erroneous. If comparisons are made on a correct basis and attention paid to the fact that recent longitudinal shops are being built with wider track spacing and width of shop than older ones, it will be found that longitudinal and cross shops run about even as far as floor space is concerned. Dependent on the assumptions, the figures can almost be made to throw the balance one way or the other.

Longitudinal shop advocates claim that they can increase the engine standing capacity not only by standing engines on the middle communication track, but also by placing engines on trestles between the track. It is true that a few engines can be placed on the middle track and stripped, provided the outlook shows that no engines will be ready to leave the shop until the middle track will be free. But the objection to this scheme is that, under the pressure to get engines into the shop and started, this middle track will be filled up, thus holding completed engines in the shop. The middle track is the communication track and should be kept practically open all the time and the capacity of the shop figured accordingly. The proposition to transfer engines lengthwise between the tracks is not a safe method unless the two overhead cranes are rigidly connected by swinging arms. In regard to placing engines between longitudinal pits, spaced 22 ft. to 25 ft. centers, which is current practice, it is just as feasible to place them between cross pits spaced 22 to 24 ft. centers, which is the modern spacing for cross pits. To clutter the floor space with extra engines and dismantled parts is certainly not economical or conducive to quick work. It sounds well to have a large number of engines in a limited space, but total shop output tells the story.

In regard to height of side walls and buildings, the crane girder runways of modern longitudinal shops are only from 6 to 12 ft. below the runway in cross shops with heavy traversing crane, and usually the increased height of erecting shop is advantageous to get better light from the upper windows above the adjacent machine shop roof. But even admitting this extra height of building, it does not warrant disregarding all advantages that the cross shop may have, especially as the question is not entirely one of first cost of structures.

In longitudinal shops two cranes are used for transferring engines from the middle to the side track. The cranes are usually each from 50 to 70 tons capacity, so that one crane can handle a boiler or both cranes pick up and move sideways the heaviest engine. Cross shops have one heavy crane of 100 to 120 tons capacity for use in lifting and traversing engines, with auxiliary lighter and quick speed cranes on a lower level for general service. The longitudinal shop offers two fairly heavy crane units, which are available for light work at different points when not required for transferring engines, but they cannot pass each other in handling light work. In the cross shop there is only one very heavy crane available for general service in addition to light cranes on a lower level, better adapted for general service, as they are moved more quickly and can pass under the heavy crane. When an engine has to be transferred the longitudinal draws on two cranes, where the cross shop draws only on one, leaving one other small one free for general service. In both cases there are two crane men required. As far as service is concerned the two cranes in the cross shop will give more service than the two in the longitudinal shop. As regards first cost, two 50 to 70 ton cranes will cost as much, if not slightly more, than one 100 to 120 ton crane, so that the difference in first cost is, as a general statement, the increased cost of the light auxiliary crane in the cross shop.

It is further frequently claimed that the width of the erecting shop and span of crane in a longitudinal shop is less than in a cross shop. A comparison of recently built longitudinal shops and cross shops with heavy traversing crane shows the following crane spans:

Longitudinal shops.—Juniata, 68 ft.; Concord, 66 ft. 4 in.; Dubois, 68 ft.; Elizabethport, 80 ft.; Omaha, 69 ft. 9 in.; Topeka, 72 ft.; Montreal, 77 ft.

Cross shops with heavy traversing crane.—McKees Rocks, 66 ft.; Reading, 66 ft.; Collinwood, 65 ft. 6 in.; Brooks Locomotive Works, 64 ft. 4 in.; Richmond Locomotive Works, 70 ft.; Paterson Locomotive Works, 60 ft.

It is not necessary to have the crane span over 60 ft. in a cross shop with traversing crane if one side or both sides of the erecting shop are provided with additional bays of lower roof construction under which the wheels and sundry work around the engine can be performed.

A comparison of crane spans, therefore, shows if anything in favor of cross shops with traversing crane.

As to actual speed of the crane work in transferring engines, statements vary considerably. It is probable that there is not very much difference in the time between the two systems as far as actual transfer of engines is concerned.

The claim is frequently made that in a large shop the longitudinal layout offers a shorter building. This cannot be demonstrated on a fair basis. The figures are compiled on the basis of filling up the middle communication track with engines, thereby blocking all movement in and out of the house and not allowing sufficient room for passageways.

With tracks 22 to 24 ft. centers in a cross shop and allowing 45 to 50 ft. per engine on the two working tracks of a longitudinal shop, the total length of the building is about the same. To make two erecting shops so as to cut the building length in two would seem more objectionable in the longitudinal plan than in the cross plan with heavy traversing cranes. The main feature is to get one machine shop in the middle. By doubling the erecting shops in a cross shop, which is not so objectionable, the length of the cross shop will be about one-half of a longitudinal shop for the same number of engines.

The advocates of both systems claim that their particular system is the best for freedom of observation of the workmen and unobstructed view of the shop operations. In the longitudinal shop, the foreman walking down the middle aisle can see a long distance, but the workmen can also see him coming. He can only see the men on one side of the engines unless he makes three trips the length of the shop. In the cross shop the foreman in walking down the aisle at either end of the engines has about one-half the distance to travel to see all the engines, comes on the various squads of men unawares, and can see each engine complete excepting one end, and that he can take in on his return trip in the other aisle. To see all sides of all engines the foreman in the longitudinal shop has to travel twice the distance as in the cross shop before he gets back to his office.

Much emphasis is laid on the fact that in a longitudinal shop the engines are close to the machine shop. This is true of one pit, but not of the other. The transfer from the distant track to the machine shop across the pits, and especially if the middle tracks and space between tracks is filled with engines, is certainly more difficult than in the cross shop. In the latter the wheels when free are simply rolled back towards the machine shop side on the same pit tracks, and vice versa, are returned in a similar way. There may be advantages in a longitudinal shop where building only is done, as all new parts are brought from other shops on the middle track to the engine, dropped off on the floor and then assembled. But in a repair shop, where all movements are double, from the engine and back to the engine, this double movement over pits and tracks sideways is certainly objectionable.

The only remedy is to duplicate the machine shop in two units, one on each side of the longitudinal shop, which was adopted at the Dubois shops of the Buffalo, Rochester & Pittsburgh, built in 1901; Concord shops of the Boston & Maine, in 1898; Aguas Calientes shops of the Mexican Central, in 1902; Topeka shops of the Atchison, in 1902, and Montreal shops of the Canadian Pacific, in 1902. This scheme cuts off good side light from the erecting shop, and it is objectionable to have two machine shops if it can be avoided. The engines in a cross shop can be placed just as close to the machine shop as on the first pit in the longitudinal shop, while the other pit in the longitudinal shop is certainly at a serious disadvantage unless the double machine shop is adopted.

Arguments have been made for one or the other system based upon the sum of all distances traveled from the center of each shop to the center of all other shops in the group. These figures are misleading, whichever way they may tend, and are not representative of actual conditions.

In the cross shop of the Pittsburgh & Lake Erie at McKees Rocks, a yard track enters the building without a turn-table. At the Collinwood shops of the Lake Shore and the Reading shops of the Philadelphia & Reading, turn-tables have to be used to take engines in or out of the shop. Turn-tables are objectionable, but they can be floored over to keep the pit from filling with snow.

A summary of some recent installations of large locomotive shops since about 1890 is given below:

1. Longitudinal shops.—Pennsylvania, Juniata shops, Altoona, Pa., 1890: Boston & Maine, Concord, N. H., 1898, 12 engines; Buffalo, Rochester & Pittsburgh, Dubois, Pa., 1901, 14 engines; Central of New Jersey, Elizabethport, N. J., 1901, 20 engines; Mexican Central, Aguas Calientes, Mex., 1902, 20 engines; Union Pacific, Omaha, Neb., 1902, 18 engines; Atchison, Topeka & Santa Fe, Topeka, Kan., 1902, 24 engines; Canadian Pacific, Montreal, Can., 1902, 42 engines. Well known plants built prior to 1890 are the large Horwich shops, England, and the Norfolk & Western shops, Roanoke, Va.

2. Cross shops with heavy traversing crane.—Philadelphia & Reading, Reading, Pa., 1901, 70 pits; Lake Shore & Michigan Southern, Collinwood, Ohio, 1902, 24 pits; Pittsburgh & Lake Erie, McKees Rocks, Pa., 1902, 24 pits.

It is also pertinent to note that in England, where for years the longitudinal shop has been the preferred type, the transverse shop with heavy traversing crane for lifting engines over each other sideways has been adopted, for instance, at the Inverarie shops of the Great North of Scotland, built about three years ago. The recent introduction of the double machine shop scheme at the longitudinal shops at Dubois, Concord, Aguas Calientes, Topeka and Montreal, would seem to be an acknowledg-

ment of the defects of the old longitudinal shop with one machine shop.

Attention should also be directed to the composite character of the Central of New Jersey, Elizabethport, layout, where a longitudinal shop connects with a transfer table and in addition is provided with two heavy cranes for lifting locomotives; in other words, a mechanical transfer equipment fully equal to a transfer table cross shop with light overhead cranes or to a cross shop with heavy traversing cranes. The same feature occurs in the full development scheme for the future, as shown on the adopted layout for the Dubois shops, where a transfer table may be used some day to connect the tracks at one end of the longitudinal shop. The erecting shop at Horwich, England, has two transfer tables running across the 1,520 ft. long erecting shop to facilitate movement of engines.

A prominent example of a recently built longitudinal shop, namely, at Dubois, was adopted largely through the advice of the leading consulting motive power expert employed by the railroad company, but there was an alternate cross track plan worked up at the time which was much favored by motive power officers of the railroad company, although the longitudinal layout was finally adopted.

Principal conclusions regarding "Longitudinal vs. Cross Erecting Shops" are as follows:

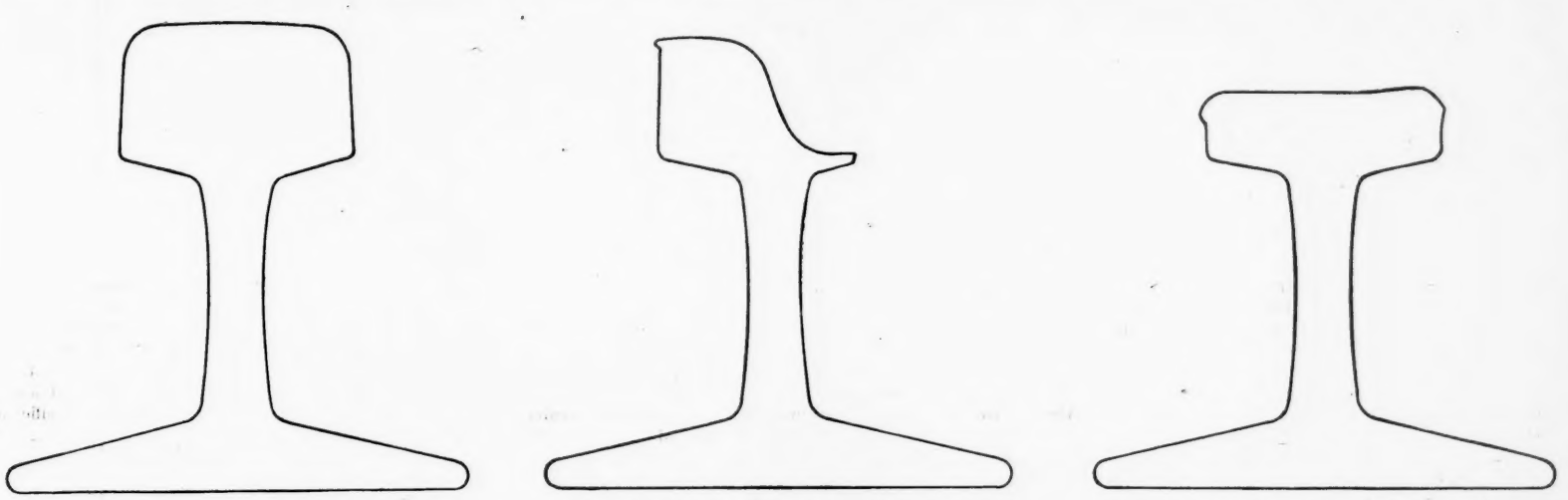
Individual preferences, local conditions and requirements, the prevailing practice on each road or custom in each section of the country, will frequently influence the layout more than the alleged advantages of one or the other system, but, assuming ample space and freedom in adopting a design, the following layouts would seem the best.

In a small general repair plant with not over 15 erecting pits, one transfer table serving all departments offers a neat, compact and economical layout.

In larger plants, up to about 25 erecting pits, where the locomotive department occupies a separate group of buildings, the longitudinal shop has in northern climates advantages over the cross shop with transfer table layout. The longitudinal shop is generally cheaper in first cost than a cross shop with heavy overhead traversing crane for lifting engines laterally over others standing on the floor. The longitudinal shop, especially when having only one machine shop on one side of the erecting shop, will always have objectionable elements in operation as compared with a cross shop. The latest practice is to use double machine shops, one on each side of the longitudinal erecting shop, which, while objectionable, is an improvement over the old style with one machine shop.

For very large plants, the cross shop system with heavy high traversing crane for lifting engines laterally over other engines standing on the floor is to be preferred. If the cross tracks in the building run at right angles to the general yard track layout, then a turn-table has to be used at the entrance to the house. In northern climates the turn-table pit should be covered. If the cross tracks in the building run parallel to the yard tracks, then no turn-table is needed and the additional advantage is offered that several pits in the building can have track doors with track approach for comparatively light repairs and hence such engines can be taken in and out of the house cheaply and quickly.

(To be Continued.)



Pennsylvania R. R. Standard 100-lb. rail. (½ linear scale.)

High rail laid in May, 1895; weight, 100 lbs. Removed in September, 1897; weight, 79 7/10 lbs.

Low rail laid in May, 1895; weight, 100 lbs. Removed in September, 1897; weight, 84 lbs.

Wear of Rails on South Track, "Horse Shoe Curve," Pennsylvania Railroad.

Experience With the Per Diem Car Service Rules.*

Mr. Sipp began with a brief history of the agitation of the per diem theory, beginning with the organization of the Car Accountants' Association in 1875. The first committee was appointed in 1884. In 1887 and 1888 per diem was given a trial by a number of eastern roads. The successful movement of last year was begun by the action of the American Railway Association in St. Louis, in October, 1901. Mr. Sipp developed his subject by quoting the principal rules of the per diem code, explaining each one in order. In connection with rule No. 3, on the penalty rate of 80 cents a day, he says that sentiment in favor of a higher rate has increased since the results of experience have become known. The next rule taken up is No. 5, the reclaim rule. From this point Mr. Sipp goes on as follows:

The number of days allowed for the switching and for what reclaim of the per diem that can be made by the road performing the service has been fixed, not as a minimum, but as an average. It should always be borne in mind that there is a fixed amount to be paid for each foreign railroad car, and when it is possible to perform the service in a less time than has been agreed upon, it means that the switching road will have earned whatever is paid for the time that has been saved; that is, when the reclaim is fixed at four days and a road receives and returns car in three days the switching road will pay owners of the car for three days, and will receive four days' reclaim from the road for whom the switching was done, which will result in earnings for the road.

These reclaim accounts must show the number and initial of each car moved in switching service, the date handled, and the agreed number of days must be reclaimed in each case, the average being one day per car for intermediate line and four days per car for terminal switching.

The reclaims are provided for by rule, this rule to protect intact the original switching rate in force prior to the introduction of the new system by rebate of per diem paid by the switching road on cars handled in switch service.

If some arrangement could be arrived at, under proper safeguards, by which the agreed allowance of per diem could be added to the switching rates, the same results could be obtained with a decrease of clerical outlay, and agents would not then be required to go twice over the same voluminous accounts and check vexatious correspondence over wrong car numbers and initials. A very strong sentiment exists in certain quarters that reclaims should be abolished, and the first step in that direction was taken by the general superintendents of the roads centering in St. Paul and Minneapolis at a recent meeting. The question was referred to the officers in charge of car service matters, and they held a meeting January 3, and recommended that reclaims be abolished to date from January 1 for cars handled in switch service in Twin City terminals; that Belt lines be required to report per diem on all cars foreign to delivery line, and that they be allowed reclaim for amounts so paid with a maximum time of three days. Further, that they be allowed arbitrary time of three days for cars handled in switching service for the account of other lines, the expense of accounting to other lines for per diem, under this agreement, to be borne by delivering line upon the bases of number of cars handled for account of each line.

"In case a road delivers an empty foreign car, without the consent of the owner, to a road which does not pay per diem, or if a road permits the loading or reconsigning of a foreign car without the consent of the owner to such road, it shall be responsible to the owner for the payment of an amount equal to the per diem accruing on the car while on such road."

In the translation of this rule as to liability for per diem on loaded cars delivered to a non-per diem road, there is extensive opportunity for difference of opinion and differences of accounts. By reason of the difficulty of owner in establishing the loading or reconsigning of the car by the delivering road to the non-per diem road, from the fact that car might have come to the delivering road either under through load from the home road or diverted by some intermediate road, the delivering road, if they desire, can refuse all liability for per diem, unless it can be proved that the delivering road loaded or reconsigned such cars. However, there have been but few cases where roads have declined to assume this liability, as indications point to a disposition on the part of the railroads to be liberal in this respect. . . .

When a car is detained awaiting the receipt of repair material from its owners, the per diem charge will cease from the date the material is ordered; but begins as soon as the material is received at any point on the line holding the car, and penalty, if notice has been served, begins 10 days later. As a rule, material ordered to make repairs consists of very small lots almost impossible to trace to destination.

The Interchange Reports prior to the inauguration of per diem were weak features of the Car Accounting System, but under the new plan it is absolutely necessary that each and every car be accounted for; in other words, should cars be delivered connecting lines and not reported, per diem is accruing on a car not in your possession. In addition, should cars move from junction points, and if their receipt be not reported, the running record is left open, and the per diem days due on the car cannot be computed until receipt is obtained.

The idea of rule 14 is to make it worth while for the road to declare an embargo as early as possible, instead of letting things slide along until there is a greater number of cars ready for it before it puts the embargo into effect. Rule 15 shows how a road can be relieved from penalty imposed by rule 14. The intent of this rule was to make embargoes profitable, so that people would know in advance how many cars could be shipped, and so that this overshipment could be stopped.

The delivering road should give notice of the placing of embargoes with the carrying road, and the carrying road is expected to pass it on. In the handling of reclaims under these rules there is too much room allowed connections in reference to the actual cars on which per diem is reclaimable. The road placing the embargo should, within 24 hours after the embargo has been placed, be furnished with a detailed list in duplicate showing numbers and initials, location and date of cars held; this policy to continue daily covering additional cars tied up until the embargo has been lifted. This method of handling will enable the road placing the embargo to properly check the accounts of embargoed cars; whereas, if wire notices are accepted, and accounts are to be settled for in accordance therewith, there is a likelihood of payment being made on cars belonging to roads which are not members of the Code, or on private equipment, which are exempt from the per diem rules.

The workings of the per diem system, so far as the Chesapeake & Ohio is concerned, have clearly demonstrated its merits. Exhibit "A" shows the daily average number of C. & O. cars on the home road for the six months ending December, 1901, as compared with the same period 1902 (increase 14 per cent.):

Exhibit "A."

Month.	1901.	1902.	Increase
July	11,096	11,855	759
August	11,738	12,179	441
September	11,412	11,905	493
October	10,845	13,708	2,863
November	11,002	13,328	2,326
December	11,057	13,493	2,436

Exhibit "B" shows the average daily number of foreign cars on the Chesapeake & Ohio for the six months:

Exhibit "B."

Month.	1901.	1902.	Decrease.
July	5,350	4,312	1,038
August	5,365	4,036	1,329
September	5,921	4,699	1,222
October	5,768	4,538	1,230
November	5,725	4,883	842
December	5,493	5,908	*415

* Increase.

With but one exception (December, 1902, due to embargoes in effect), the decreased average detention per car of foreign cars on the Chesapeake & Ohio for the same period in 1902, as against 1901, decreased 874 cars, or about 15.6 per cent. This decrease in the number of foreign cars handled is due to connecting lines sending C. & O. cars home under load, thus reserving their own cars for local service; in addition, by reason of coal strike during the period of 1902, the industries located on our line evidently reduced considerably their orders for material from foreign sources, and foreign cars were not held for coal and coke loading.

Exhibit "C" shows the average daily number of C. & O. cars off home grounds for the six months ending

*Extracts from a paper read before the Richmond (Va.) Railroad Club, March 12, by George S. Sipp, Car Service Agent of the Chesapeake & Ohio.

December, 1901, as compared with the same period 1902:

Exhibit "C."

Month.	1901.	1902.	Decrease.
July	7,375	7,421	*46
August	7,089	7,032	57
September	7,412	7,352	60
October	8,137	6,634	1,503
November	8,202	7,890	312
December	8,481	8,073	408

*Increase.

Exhibit "D" shows receipts and disbursements for the six months ending December, 1901, as compared with the same period 1902:

Exhibit "D."—(Cents omitted.)

1901.

Month.	Receipts.	Disbursements.	Favor C. & O.	Favor foreign roads.
July	$19,307	$27,940	...	$8,632
August	20,050	31,650	...	11,600
September	21,504	32,052	...	10,547
October	21,944	34,156	...	12,211
November	26,359	31,902	...	5.543
December	26,361	27,160	...	799
Total	$135,527	$184,861	...	$49,334

1902.

Month.	Receipts.	Disbursements.	Favor C. & O.	Favor foreign roads.
July	$21,707	$24,641	...	$2,933
August	22,264	25,193	...	2,928
September	28,921	25,925	$2,995	...
October	28,415	31,245	...	2,829
November	36,630	32,310	4,320	...
December	51,100	34,864	16,235	...
Total	$189,039	$174,180	$23,550	$8,692
Balance in favor of C. & O. Ry. Co				14,858

For the six months ending December, 1901, on the mileage plan the C. & O. disbursed $49,334 for car hire above that received, or an average of $8,222 per month. Whereas, for the same period 1902 a credit balance of $14,858 is shown, with a monthly average of $2,476 under the per diem plan.

I desire to call your attention to the good results which have been accomplished by the local Car Service Associations. The National Association will have been in existence some 13 years this coming month. During the year 1901 there were reported by the various managers to the secretary of the National Association 19,617,500 cars, with a total average detention by railroads in placing, and by the shippers and consignees in loading and unloading, of 1.72 days per car. This average detention, as compared with that prior to the establishment of demurrage rules, shows a decrease of 4.45 days per car, the estimated average detention being reckoned at 6.17 days per car.

Paint.*

Oil paints as made and used to-day are based upon the theory that the solids are coefficient with the liquids in producing the best materials, and that the secret, if there be any, lies in the adjustment or determination of the amount and kind of each needed commixture to secure the best results. Oil paints may be defined as a close union of solids or pigment and liquids or binders; *i.e.*, we take inorganic or solid matter in a finely divided state and mix it with organic or liquid matter and then try to link them together either chemically or mechanically. Ordinary mechanical mixtures in which the pigments and liquids have little or no affinity for each other or in which the powders are feebly suspended in the liquid scarcely deserve the name of paint. . . .

What are the essentials of a good structural oil paint? They may be stated as follows, viz.: (1.) It must work properly. (2) It must dry fast enough. (3) It must wear well. (4.) It must produce a satisfactory appearance. (5.) It must exclude moisture from the material covered with it; i.e., preserve it.

In addition to these essentials that of cost must be considered. The average buyer thinks too much of the first cost of his material, not enough of ultimate results. Gardner gives the following excellent rule for getting at the economic value of a paint: "Divide the total cost of painting and repainting in a given period by the number of years of service, thus obtaining the average cost per year of the paint and painting."

Wood usually contains water, extractives, ligno-cellulose and mineral matter, the first two being the enemies of paint. An oil paint made to preserve, to protect or to improve wood in appearance must be repellent of water, for water and sap cause the decomposition of wood. If the paint is composed of hydrofuge materials, one cannot expect it, from its very nature, to stick to a wet or damp surface. Wood fit to give the best results in painting should be from the heart of sound trees, the sap entirely removed, straight in fiber, free from large or dead knots, flaws, shakes and blemishes. Most of the complaints of paint spotting, cracking, crawling, wrinkling and blistering on wood, may be attributed to water, sap, soot or grease under it. Sometimes the character of the surface demands special treatment. You cannot conceive that there is continuity of matter in the surface of a board. Highly magnified, its pores or cells are plainly visible, and all the well known phenomena of capillarity or surface tension determine that the surface of lumber used in ordinary construction is neither a very stable nor an even one, and these phenomena indicate that these forces may have more power than that due to mass attraction or gravitation. In other words, some parts of a board will suck the liquid out of an oil paint, leaving more or less of the dry pigment on the surface, while others less absorbent will support the paint so that it will have the desired appearance. . . .

Pigments fit for use in structural oil paints are of two general classes, viz.: Those that react more or less with the oil, notably the carbonates and all of the lead pigments, and those that have no chemical action on the oil or binder, i.e., that are called inert, such as the carbons, silicates, probably ferric oxides, etc. The former class produce the quicker drying and the less durable paints, the latter the slower drying and more durable coatings; *e.g.*, a paint made from white lead and linseed oil when properly applied to a sound surface cannot be expected to protect it, under fair conditions, more than five or six years; while a paint made from Venetian red and the same oil applied to a like surface, under similar conditions, will protect it easily twice as long. You will note this if you will recall your observations of the durability of paint made from ordinary mineral colors on barns or freight cars as compared with the more delicate tints used on houses and special line cars. Another feature of interest pertaining to "inert" pigments is that where the same liquids are used with them for the paint for each coating that is applied, you find that the dried paint seldom cracks, peels, or blisters, and if it does the inference should be that your paint contained an inadequate amount of pigment.

To understand the pigment question, one needs some knowledge of forces which are insensible at sensible distances, viz.: Molecular forces, such as surface attraction, chemical affinity, etc. All phenomena taking place in paint are due either to physical actions (heat, light) or to chemical actions; *i.e.*, the attractive or decomposing influence of one substance upon another. Why do we use pigments with oil paints? Is it for color only or is it because the pigment protects the oil as much as the oil does the pigment? Pigments are probably used in oil paints for one or more of the following purposes: (1.) To color or better the appearance of surfaces. (2.) To permit the application of more oil to surfaces than could be accomplished by the use of oil alone. (3.) To mechanically protect the oil. (4.) To hasten the hardening of the oil. (5.) To increase the thickness of the covering layer.

The first point is obvious and calls for no discussion. The second and fifth are analogous, embodying the same principle; I will endeavor to explain them jointly. Oil applied to a smooth, non-absorbent vertical surface runs off until it reaches a certain thickness. The layer, after it has dried, forms a film so thin that it is difficult to measure it with a micrometer gage. Now if pigment is added to the oil, we get a thicker layer. Moreover with any given pigment as standard, the more finely it is divided, the thicker will be the layer formed with a given proportion by weight to the oil.

Andes, in his work on anti-corrosive paints, in discussing the number of coats of oil paint that must be applied to iron in order to secure efficient protection against rusting, says that, in establishing a standard, preference must undoubtedly be accorded to paints requiring a large proportion of oil to make them work properly. He says, "It may be laid down as a normal standard that, presupposing the use of good paint, one bottoming coat and three subsequent coatings, laid on at suitable intervals, will be required to produce a layer of oil paint of sufficient thickness on iron to keep moisture away from the metal and to protect the latter from rust for a certain time." The problem of wear seems to be for us to determine what materials shall be taken as pigments and in what state of division they must be so that by their power of adhesion to the oil they will secure coatings of the greatest thickness.

The third point, viz., that pigment is used to mechanically protect the oil, can be abundantly illustrated. Two essential properties of a durable pigment are that it shall be insoluble in water, and that it shall take hold of and retain the oil. . . .

If durability is the main desideratum, pigments that have no chemical effect upon the binder produce the most desirable paints. But if quick drying is wanted, and further if it is desired to avoid the use of caustic siccatives or volatile substances, then we can see why pigments are used to assist the hardening of the oil, as indicated in the fourth point. Pigments like white lead and red lead react with the oil. The former contains, or should contain, quite an amount of constitutional water, i.e., it should be about 33⅓ per cent. hydrate. White lead saponifies oil and therefore a white lead paint works well, dries well, and decomposes somewhat rapidly. The action of red lead upon linseed oil differs from that of white lead in that the former is anhydrous. Red lead produces a more insoluble soap from oil than white lead; its characteristics are rather those of a plaster than of a soap. A little red lead or white lead added to pigments like graphite, lamp black, oxide of iron, etc., always makes them not only dry better, but, under ordinary methods of painting, wear better.

Adulteration.—What is an "adulteration" of a pigment? It is anything that lessens its ability to perform its essential requirements as a pigment: e.g., suppose you want a black paint and propose to use lamp black as coloring matter. It can readily be demonstrated that where a black paint is wanted, if in compounding the pigment you will take from 15 to 20 per cent. of lamp black and then supplement it with a small percentage of red lead for drying purposes and a large percentage of some inert powder like gypsum, silica, or what not for mechanical protection, you will secure from it, with linseed oil, a paint of much higher efficiency than all lamp black. The question naturally arises, are the red lead and inert substances that are added to the lamp black adulterations or not? The same principle holds with oxide of iron. There is no use in making a paint from a pure oxide of iron. Such a paint in all probability will prove less efficient than one in which the pigment has been largely combined with some hard, inert powder.

Influence of Grinding on Shade.—Hurst tells us that there are three constants which accompany every color, namely: hue, luminosity and purity. Many pigments are claimed to be amorphous. However, the writer is of the opinion that all pigments fit for use in paint-making have defined structure, i.e., are crystalline. You can determine the influence of grinding upon any given pigment by placing a small portion of it in an agate mortar and then rubbing it well with an agate pestle. You will find that the influence of grinding on many pigments is to lighten their color: e.g., chromate of lead (chrome yellow) of an orange color will become more of a lemon color; a well burnt red lead with deep orange hue will become, after hard rubbing, much more yellowish; ferric oxides that are purplish will become more red; those that are red will become more yellow. As a rule, therefore, all hard stable compounds are invariably made lighter by grinding; white and black pigments of course excepted.

Adulterations in Linseed Oil and Paint.— . . . I fancy that if more study were given to films of dried paint, dried linseed oil (linoxyn) and dried varnish, more rapid progress in the science and art of paint-making and painting would result. Modern railroad conditions demand rapidly drying paints. Linoxyn is not quickly formed without light, good ventilation and moderate artificial heat. To enable themselves to use elastic and durable paints, the better managed of our railroad companies have provided their painters with shops adequate to enable them to satisfy these demands. Bridge painters, house painters and freight car painters still suffer from having to do their work under variable conditions out of doors. These conditions have created of late years an enormous demand for quickly drying thinners of all kinds to take the place of the slow but sure medium, linseed oil. These thinners or adulterations, if they may be so considered, consist largely of volatile matter. We find them to contain all the way from 25 to 85 per cent. by weight, of such things as naphtha, benzol, coal oil, spirits of turpentine, etc. They dry almost wholly by evaporation; not, like oil, by oxidation. They are made on the principle that japans or furniture polishes are made. Some of them, if used in reasonable proportions, insure much better results for the painter than he can possibly get from the use of paint made from linseed oil and the class of japans and siccatives usually furnished to him.

None of the linseed oil sold is perfectly pure. Impurities like water and albumen are readily detected, but impurities like the oil extracted from the seed of weeds, etc., generally associated with the flax plant, it is almost impossible to detect. Commercial flaxseed usually contains a large amount of foreign seed like wild mustard seed, for instance, the effect of which is to make the oil slower drying and therefore less efficient as a paint oil. If mineral or resin oils are added to linseed, they may be readily detected. There are many simple chemical tests that determine them. We do not find such adulterations common. There is a class of hidden adulterations that are sometimes added to oil when it is high in price that are difficult to detect, such as corn oil, cotton-seed oil and fish oil. Boiled linseed oil is such an uncertain quantity that much of it is adulterated with mineral oils or resinous products of various kinds, none of which are equal in quality to good boiled oil.

Influence of Gums on Varnish.—Church tells us that, "The true gums are either soluble in water or swell up in that liquid, but resins are not acted on by water." Resins are the ingredients which impart hardness and brilliancy to varnishes. The harder they are the longer will the varnishes made from them hold their luster under any conditions of exposure on surfaces. "Long oil" varnishes are products in which it is attempted to make linseed oil that has been more or less resinified by heat and other treatment take the place of fossil gum. While they wear fairly and work well, they lack bearing-up qualities and soon lose their luster. The principle upon which resins are used in varnish is somewhat analogous to the principle on which pigments are used in paints. Oil gives elasticity or toughness to either paint or varnish, and pigments or resin in a similar way give hardness or firmness to either paint or varnish. We therefore conclude that if the resin (gum) used in making a varnish has greater power to resist atmospheric influences and the action of the sun's rays than linoxyn it will prolong the life of the varnish; otherwise it will shorten it.

Methods of Testing.—It is desirable in testing oil paints to avoid any interference of the surface with the paint covering it and also at times to get a look at the back of the specimen to note changes in hiding power, texture or color. Therefore, pieces of dry polished glass afford the most accurate means of measuring such phenomena.

No one can test the working properties of a paint as can the workman whose eye and hand and arm are skilled to practice. As to this feature we abide by the decision of unprejudiced and competent workmen.

The most important property of linseed oil is its affinity for or relation to oxygen. Paints should not only dry (oxidize) fast enough but they should dry simultaneously throughout, not skin over. In tests of the drying of paints care must be taken that they are spread out into

*Abstract of a paper presented to the Western Railway Club, March, 1903, by Mr. Houston Lowe, Vice-President Lowe Bros. Co., Dayton, O.

even layers of uniform thickness. Notes should be made of the temperature and humidity of the atmosphere; of the time when the paint no longer sticks to the dry skin of the finger, and of the time when the layer cannot be moved under heavy pressure.

The deterioration of paint is due to chemical change. Heat and water facilitate chemical reactions, therefore if a method could be devised of subjecting films of paint to the alternate decomposing influences of heated air and cold water we might gain a quick process for approximately determining the stability of paints. Our present method of testing durability we call "weather testing," i.e., subjecting the panels of glass, steel, wood, etc., covered with the paints to atmospheric influences out of doors. Our racks for these panels face southwest; they are placed at an angle of about 45 deg., and one-third of each panel is so protected or covered that water and the direct rays of the sun are excluded.

The impermeability of dried paint to water can be tested by letting a few drops of water fall upon a layer of it and then covering the wetted part with a watch glass and then sealing up the edges so that air is excluded. If the film is impervious to water, it (the water) placed upon the film will remain on its surface, otherwise it will penetrate it. The tests for the spreading and hiding power, precipitation and adherence of paints are obviously so simple that a description of them is uncalled for.

The Original Cantilever—Perhaps.

The photograph herewith reproduced is of a log cantilever bridge near Darjeeling, in the Himalaya Mountains in North-western India, on the border of Thibet.

The Original Cantilever—Perhaps.

It is understood that the design has been in use since a remote period. It will be seen that the mechanical principles involved are quite correct.

New Lackawanna Car Shops—Tool and Power Equipment.

The new shops of the Delaware, Lackawanna & Western at Scranton, Pa., were described in these columns in January last. Some details of the power and tool equipment are interesting. The power plant will contain 1,200 h.p. of boilers and the engines will be tandem compound non-condensing. The exhaust steam will be used for heating the buildings in winter and at the dry kiln. Two 300 k.w. and one 100 k.w. dynamos are to be installed. The horse-power required to drive the tools when working at maximum capacity is estimated as follows:

Machine shop	100
Blacksmith shop	140
Mill	535
Crane	25
Total	800

It rarely happens, however, that more than 35 per cent. of the maximum power is required. On that basis the actual power required for driving the tools is but 280 h.p. Adding to this figure 100 h.p. for running the blowers in the blacksmith shop and 100 h.p. for driving the fans for removing the shavings in the mill, gives 480 h.p. as the normal load in summer. The heating and lighting in winter requires about 280 h.p., which brings the total up to 760. The dynamos are guaranteed to carry a steady overload of 25 per cent., which is equal to 1,172.8 h.p. and an overload of 50 per cent. for a short time, which gives 1,407.5 h.p. From these considerations it appears that ample margin has been allowed for the addition of other tools and machinery, without the necessity of enlarging the power plant.

A list of the principal tools for the several shops follows. Many of these came from the old shops.

MACHINE SHOP.

Machine.	*Maker.*
Hydraulic wheel press for pressing on	D. L. & W.
Hydraulic wheel press for pressing off	D. L. & W.
Two car wheel boring mills	Niles Tool Works Co.
Wheel boring mill	Bement, Miles & Co.
Axle centering machine	D. L. & W.
Lathe for 36-in. steel-tired wheels	Bement, Miles & Co
Emery grinder	D. L. & W.
Lathe, 7-in. swing	D. L. & W.
Gang drill	Bement, Miles & Co.
Single head axle lathe	Bement, Miles & Co.
Double head axle lathe	Putnam Machine Works
Lathe, 7-in. swing	
Drill (very old)	New York Steam Engineering Co.
Drill	W. F. & John Barnes
Lathe, 30-in. swing	Pond Machine Tool Co.
Double head shaper	Niles Tool Works Co.
Drill	Prentice Bros.
Lathe, 15-ft. bed	
Drill press, No. 757	Bement, Miles & Co.
Lathe, 10 ft. bed	Stover Machine Co.
Planer, 11 ft. 6 in	Niles Tool Works Co.
Pipe cutter	
Twist drill grinder	L. S. Heald & Sons
Bench drill	D. L. & W.
Grinder for mine car seats	D. L. & W.
Five double head bolt cutters	National Machinery Co.
Lathe, 15-ft. (new)	" "
Large drill (new)	" "
Three-spindle bolt cutter (new)	" "
Large nut tapping machine (new)	" "
Small nut tapping machine (new)	National Machinery Co.
Small turret lathe (new)	" "
Grinding machine (new)	" "
Grind stone (new)	" "
Power hack saw (new)	" "
Slotter (new)	" "
Lathe (new)	" "
Milling machine (new)	" "
Two single head axle lathes (new)	" "
Drill for tool room	" "
Small drill (in blacksmith shop)	" "
Large drill (in blacksmith shop)	" "

MILL.

Machine.	*Maker.*
Double planer and matcher, No. 14	S. A. Woods Mach. Co.
Swing saw, 30-in	D. L. & W.
Two rip saws, 24-in., No. 175	S. A. Woods Machine Co.
Double planer and matcher, No. 17	S. A. Woods Mach. Co.
Outside moulder, 6-in	C. B. Rogers & Co.
Crosscut saw, 40-in	S. A. Woods Machine Co.
Sill tenoner, No. 0	C. B. Rogers & Co.
Cross-boring machine, No. 330	S. A. Woods Machine Co.
Four-spindle boring machine, No. 325	S. A. Woods Mach. Co.
Three-spindle vertical boring machine	C. B. Rogers & Co.
Rip saw, 30-in	D. L. & W.
Automatic crosscut saw, 36-in., No. 3	J. A. Fay & Co.
Sticker, 5-in. head	Levi P. Houston & Co.
Upright shaping machine, No. 0	C. B. Rogers & Co.
Matcher	Egan Co.
Gaining machine	C. B. Rogers & Co.
Gaining machine, pneumatic	D. L. & W.
Hollow chisel horizontal mortiser, No. 7	S. A. Woods Mch. Co.
Three-spindle boring machine	Berry & Orton
Three wood turning lathes	
Saw grinding and sharpening machine, No. 231	S. A. Woods Machine Co.
Automatic knife grinder, No. 221	S. A. Woods Machine Co.
Band saw filer	Chas. E. Wright & Co.
Band saw, 36-in., No. 3	C. B. Rogers & Co.
Swing saw, 22-in., No. 232	S. A. Woods Machine Co.
Hand planer	C. B. Rogers & Co.
Double tenoning machine, No. 3½	J. A. Fay & Co.
Extra heavy 6-roll sizer, 4 sides, No. 8	S. A. Woods Mch. Co.
High speed flooring machine, No. 27	S. A. Woods Mach. Co.
Double cutting-off machine, No. 3	J. A. Fay & Co.
Vertical car boring machine, 4 spindles, No. 321	S. A. Woods Machine Co.
Vertical car boring machine with universal attachm't, No. 321	S. A. Woods Mch. Co.
Heavy self-feed rip saw, 30-in., No. 153	S. A. Woods Mch. Co.
Combination vertical borer and gainer	S. A. Woods Mach. Co.
Small horizontal hollow chisel mortiser, No. 7	S. A. Woods Machine Co.
Hollow chisel mortiser, No. 6	S. A. Woods Machine Co.
Vertical car tenoning machine, No. 0	C. B. Rogers & Co.
Double tenoning machine, No. 7	J. A. Fay & Co.
Car brace cutting-off saw, No. 1	J. A. Fay & Co.
Crosscut saw	D. L. & W.
Cut-off saw, 22-in., No. 2	J. A. Fay & Co.
Groove saw, 12-in.	D. L. & W.
Box board matcher	D. L. & W.
Grind stone	
Heavy combined buzz planer, No. 97	S. A. Woods Machine Co.
Hollow chisel sharpener	Atlantic Works
Band re-sawing machine, No. 182	S. A. Woods Machine Co.
Sharpener for circular saws	Corse Bros. Co.

BLACKSMITH SHOP.

Machine.	*Maker.*
Punch and shear, No. 0	Hilles & Jones
Two belt hammers	The Bradley Co.
Punch and shear, No. B	Long & Allstatter
Bolt header, 1½-in.	Ajax Mfg. Co.
Alligator shears	D. L. & W.
Bull dozer, No. 7	Ajax Mfg. Co.
Blakeslee bolt header	Ajax Mfg. Co
Punch and shear, No. D (new)	Long & Allstatter
Bolt header, 1-in. bolts	
Forging machine (new)	
Eye bending machine	Williams, White & Co.
Brake-shoe key machine (new)	
Bull dozer, No. 3	Ajax Mfg. Co.
Small punch	
Jointer	

The blowers and fans, of which there are two and ten respectively, are to be furnished by the Buffalo Forge Co.

Brooklyn Rapid Transit Plans.

In the *Railroad Gazette* of Feb. 27 was printed General Parsons' report to the New York Rapid Transit Commission, presenting a comprehensive rapid transit scheme for the Boroughs of Manhattan, the Bronx, and Queens. The plan for Brooklyn was not at that time included, but was reported separately, March 12. Extracts from the report follow:

"In considering any plan for the relief of Brooklyn the question of congestion at the Manhattan terminus of the Brooklyn Bridge stands pre-eminent. The capacity of the bridge and the choking of the avenues leading to it in Brooklyn limit the capacity of all lines in Brooklyn. With increased capacity of outlet every elevated and surface track could immediately carry more trains or cars.

"To afford such relief certain improvements are in hand, and some nearing completion. The subway system is already being extended; the Williamsburg Bridge is nearly finished, and the Manhattan Bridge is well begun. When these works are completed by the city, at a tremendous cost, the opportunities will be presented to materially improve the situation. In order that such improvement shall be thoroughly effective some plan must be devised to bring the new bridges into harmonious relation with the transportation facilities. Such a plan has not hitherto been devised.

"To this end I beg leave to propose the following:

"In connection with the Brooklyn end of the Manhattan Bridge, the city authorities propose to construct a new thoroughfare along the axis of the bridge produced to the intersection of Fulton street and Flatbush avenue. Such a street intersects or reaches all the elevated lines now running to the Brooklyn Bridge. When the Manhattan Bridge is completed spurs from the elevated lines will be run over the bridge. The topography of the ground in Brooklyn is such that a connection can also be made with every elevated line so that it will run into a subway without serious interference with cross streets. Such a subway can be carried under Nassau and Orange streets and the East River to Maiden Lane in Manhattan with a station near William street. From this station one line can run across the city via Cortlandt street to West street, and another line along William street, diagonally under the present bridge structure to Park Row, thence to Centre street, to Grand street, and then under private property to the end of the Williamsburg Bridge at Delancey street, where, with but little alteration in the bridge structure, the subway tracks can be connected with the elevated tracks on the bridge. This will provide a loop for the elevated railways of Brooklyn by way of the Williamsburg Bridge and this second Brooklyn tunnel. With this subway a similar connection can be made with the elevated tracks on the Manhattan Bridge when the latter is completed, thus providing a second loop. When the elevated trains are removed from the Brooklyn Bridge the trolley cars can be transferred from the roadways to the original bridge tracks, and thus restore the roadways to the exclusive use of vehicles. Additional terminal loops for the trolley cars have been ordered for the Manhattan end of the bridge.

"To complete the subway from Williamsburg Bridge to Maiden Lane will require about two years after the necessary consents are obtained and contracts let, and three years will be required to complete the East River Tunnel. It is hoped that the Williamsburg Bridge will be opened for traffic during the present year. Some temporary arrangement must therefore be made to utilize the opportunity for additional service thus offered. This can be done by extending the elevated tracks over the Second and Third Avenue Elevated lines along Delancey street to the Bowery, and thence along the contemplated con-

tinuation of Delancey street to Elm street, thus making a connection for transfer to both the East Side elevated lines and the subway, and bringing the terminus of the Brooklyn lines near the center of commercial activity. A very much better temporary relief would be to avail, if possible, of a suggestion made in my report of February 19, wherein two additional tracks were proposed over the Second Avenue Division to City Hall. These tracks could be connected with the Williamsburg Bridge by a line only 1,500 ft. long, and a temporary connection could also be made with such new tracks at the Brooklyn Bridge. A continuous loop would thus be immediately realized.

"Should the above-described plan be carried out, the Borough of Brooklyn will then be connected with the Borough of Manhattan by three bridges carrying six elevated tracks and ten surface tracks, and two tunnels carrying four tracks, every one of which tracks will have a greater carrying capacity than either one of the two elevated or two surface tracks on the existing bridge. These increased facilities of transfluvial transit will in themselves provide the greatest single measure of relief that Brooklyn stands in need of; there remains, therefore, but to propose and to carry into execution as rapidly as possible certain extensions of the rapid transit facilities in Brooklyn, which will be rendered possible by the increase in the terminal facilities in Manhattan. These extensions should obviously be of two characters—one, the extension of the subway system wherever such extensions can be made economically, and become an integral part of the railroad system which the city has already begun; the other, extensions on such terms as the Board may determine of the elevated lines of the Brooklyn Rapid Transit Company, in order that such company may more properly fulfil its obligations. Such extensions as seem to be most important can be described briefly as follows:

FIRST—SUBWAY SYSTEM.

"This system now terminates at the intersection of Flatbush and Atlantic avenues, where a connection can be made providing means of reaching the easterly limits of the Borough of Brooklyn. From the present terminus the subway system should be extended under Flatbush avenue with four tracks to the Prospect Park Plaza. Around the outer limits of the Plaza I propose a loop, and diverging from this loop a three-track line easterly along the Eastern Parkway to, say, East New York avenue. Two of the tracks on Flatbush avenue should be depressed at the Plaza, passing beneath the loop so as to avoid grade crossing, and then be carried southerly along Flatbush avenue to, say, East Broadway. These two lines would reach a portion of the Borough of Brooklyn not now served by any of the elevated lines of the Brooklyn Rapid Transit Company, but a district second to no other in Brooklyn in desirability of improvement, and which in the near future, with proper facilities, will, beyond question, support a large population.

"Another extension of the subway could begin at Flatbush and Atlantic avenues, running south along Fourth avenue to Fort Hamilton, probably becoming elevated at some point where the topography would allow.

"When these lines are carried into execution and the traffic that they would produce has been developed, it is obvious that some further connection will be necessary in addition to the Whitehall-Joralemon street tunnel. It would seem that the best route for such a tunnel would be Atlantic avenue to Whitehall street. The Atlantic avenue line could be connected with the line that I have proposed to the Board running south along Church street, provided such line is constructed.

SECOND—BROOKLYN RAPID TRANSIT ELEVATED SYSTEM.

"Studying the local details of this system one is impressed by the fact that it is without *rapid* transit facilities, as each one of the lines is a two-track structure only, and therefore incapable of furnishing an express service. The following suggestions are made:

"1st. Add a third track on the Fulton street elevated from the end of the line at East New York to the Brooklyn Bridge.

"2d. Add a third and fourth track to the Broadway line, from the loop at East New York to the Williamsburg Bridge, and a third track from the loop to the terminus at Cypress Hills.

"3d. Add a third track to the Myrtle avenue line from Ridgewood to the Brooklyn Bridge.

"4th. Add a third track on the Fifth and Third avenue lines in South Brooklyn, from Myrtle avenue to 65th street.

"5th. Connect the Fulton street elevated, between Williams place and Alabama avenue and the Jamaica plank road. This will permit Jamaica trains to pass down either Fulton street or Broadway and avoid running through the loop.

"6th. Connect the Fulton street line and the Fifth avenue line to provide for the latter a better terminal arrangement and to serve the local shopping district in Brooklyn.

"7th. Construct a new elevated railway from the point where the Brighton Beach Railroad connects with the Fulton street line, to the Blackwell's Island Bridge, with an extension to Flushing Bay, and also a spur from Lorimer street to the Williamsburg Bridge. This line will pass through an extensive portion of the Borough of Queens, and brings it in touch with the wholesale and financial districts in Manhattan, and the retail district in Brooklyn.

"8th. Extend the Fulton street elevated from its terminus at Crescent street to the Jamaica plank road. This extension will give a direct connection to the district lying east of the terminus of the Fulton street elevated and west of Jamaica.

"9th. The Brooklyn Rapid Transit Company is now arranging by means of inclines to make a loop between the Third and Fifth avenue elevated lines to Fort Hamilton, which will very materially increase the facilities at that point. It is obvious that these facilities can be but temporary only, as these lines are on the surface, and the development of that district will, before long, prevent the continuance of running trains in this manner. Elevated structures should therefore be authorized from Third avenue and 67th street, through Third avenue to Clarke street, to Fifth avenue, and thence along Fifth avenue to 38th street, thus completing the loop in question.

"In this report no railroad provisions have been proposed to connect the Borough of Richmond with the Borough of Manhattan. After a very careful study of the problem, I regret to report that the great expense involved is entirely out of proportion to the population to be served.

"The total number of miles of new road proposed by this report is 37, and the total amount of new tracks proposed, whether in new road or as additions to existing roads, is 120 miles. An approximate cost of these improvements, exclusive of abuttal damages, is about $52,000,000, of which about $31,000,000 represents the approximate estimated cost of extending the subway and of constructing the second tunnel with its Centre street connection in Manhattan. If the Board approves the suggestion that is contained in the report that the extensions of the subway and the new tunnel with its connections should be undertaken as municipal construction, the latter figure will represent the cost of so doing."

The St. Louis Terminal Improvements.

(WITH AN INSET.)

The rearrangement of the St. Louis terminals to enlarge the capacity and provide improved and increased facilities for handling the very large business, due to the growing number of trains handled daily, and their greater length, has been mentioned before now in these columns. With the World's Fair approaching, immediate revision became imperative, and work involving a large outlay of money, and some interesting and difficult engineering problems has now begun.

The work at the station proper will include the lengthening of the tracks in the train-shed to give greater standing room for trains; rearrangement of the leads thereto, enabling a larger number of trains to be moved into and out of the shed at one time; revision of the interlocking switches, and signals; the building of a subway under the tracks, and at right angles to them, for moving baggage, mail and express; removal of the buildings of the various express companies, and the mail house, to new places; similar removal of the power station.

To clearly show the proposed changes, both the original arrangement and the plan for rearrangement, are given. Referring to the former, it will be seen that the layout of tracks in the shed and approach is such that only six of the center tracks can hold 12-car trains, now a common length. The tracks at the extreme sides accommodate but very short trains, not more than four cars with an engine.

The maximum capacity of the lead at any one time is four trains—two from the west and two from the east. The standing tracks for the express houses are joined to one branch of this lead, so that all of the express cars have to pass over this branch, causing frequent interference with regular train movements. The schedule shows 232 passenger trains into and out of the station in 24 hours. These are mostly through trains, there being perhaps not more than 10 per cent. suburban trains.

One day last summer the number of movements made at the interlocking plant in 24 hours was 1,835, requiring 24,956 lever movements. Of the 1,835 movements, 162 were freight, 573 were switching, and 736 light-engine movements. The remaining 364 were therefore passenger train movements.

Explanation of the system employed will make this better understood. In the first place it should be known that this is a back-in station. Two movements are therefore required to place a train in the shed, and one to send it out. The road engine of an inward train, after backing the train into the shed, is withdrawn and all further handling is done by the switching engine of the Terminal Association. With the present arrangement, by which the express tracks connect to the lead, sometimes as high as 11 movements are necessary to dispose of a train; this includes the backing-in, the disposal of express and mail cars by the switch engine, and placing the coaches in the storage yard. One of the objects to be accomplished was the reduction of this number of movements as much as possible.

Another matter requiring simplification was the method of handling baggage. The baggage room is now on the west side of the shed, at the north end. The outward baggage is trucked to a runway at the south end of the shed, along this to the desired track, and then along the track to the car. In the case of the tracks on the east side of the shed this requires a trip of something like 1,300 ft.—a quarter of a mile. Trains of nine cars and over have to be cut, as they cannot stand north of the transverse runway. Every train passing in or out interferes with the baggage trucking, and cutting and coupling delays trains.

In planning rearrangement there were a number of limitations encountered, the most serious being that of the confined space north and south. Expansion in either direction is impossible because of the station building on the north, and the Missouri Pacific yards on the south. To move more trains there will be two leads, each having an east and a west branch. The east and west passenger tracks, with which the leads connect, will be increased from four to six. This will make it possible to handle six trains at one time, an increase of 50 per cent. over the present arrangement.

In the train-shed the minimum clear length of track will be 863 ft., and the maximum 1,050 ft. The longest tracks will therefore accommodate 12 cars and an engine, and the shortest 10 cars with engine.

The number of switch and signal movements in the tower per inbound train will be reduced to a minimum of five. This is to be accomplished by making the mail and express tracks independent of the shed leads. The movements for disposing of an inbound train will then be: Two to back into the shed; one for the road engine to withdraw; and two for the terminal engine to take the cars out. This will greatly reduce the switching and light engine movements. The two east and west freight tracks are to be made practically independent of the passenger tracks, so that freight movements will be eliminated entirely.

The baggage subway running from Eighteenth to Twentieth streets at the south end of the shed is to have a double row of hydraulic elevators, one row being for baggage and the other for mail and express; there being one of each kind between each two tracks. The north side of the subway and the north row of elevators will be used exclusively for baggage. Each road using the station will have space allotted to it in the subway under the tracks on which its trains will usually stand. Baggage from the city for outgoing trains will be brought by the wagons into the subway and distributed to the proper railroads. When the trains are backed into the shed the baggage cars will be set opposite the elevators, which latter may be raised to the level of the car floor. Baggage from inbound trains may be unloaded in an equally short time, and if checked beyond St. Louis, is distributed in the subway.

As a part of the improvement in the baggage-handling system, much of the trouble and delay now experienced in checking and re-checking is to be done away with. In the first place, the ticket office has already been enlarged so that a larger number of people may buy tickets at once. Directly opposite the ticket office, across the waiting room, there will be a baggage ticket office. Upon buying his ticket, the passenger goes to this office and presents his ticket and baggage claim check. The destination as indicated by ticket is written on a slip and this, with the claim check, is sent by pneumatic tube to the baggage room at which the baggage has been delivered. The check duplicate is sent in return, the passenger not having left the waiting room at all. Re-checking will be done in a similar manner. Electric annunciators will be put in for notifying the baggage rooms of the approach of a train, indicating the track on which it will come in, so that men can be ready to handle the baggage the moment the train comes to a standstill.

All baggage remaining at the end of the day will be sent to the baggage house at the west end of the subway. At the present time the number of pieces of baggage to be stored daily runs from 7,000 to 12,000.

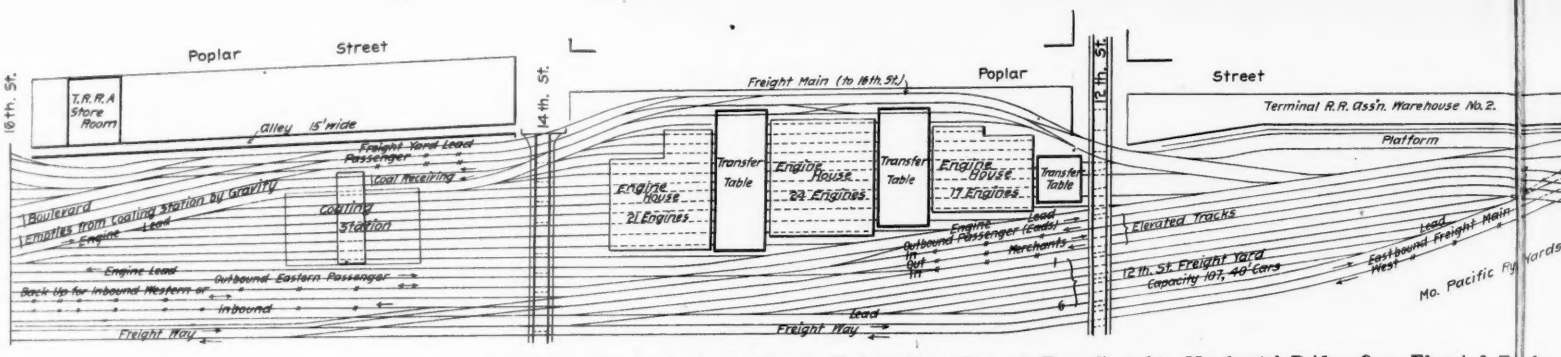
Running lengthwise of the train-shed from the baggage ticket office to the main subway will be a smaller subway 12 ft. wide and 9 ft. high. This will be used principally for carrying to and from the baggage ticket office the valises that have been checked, of which there are daily from 200 to 500. The floor of this subway will be about 6 ft. above the baggage subway; connection with the latter will be by a ramp and also an elevator.

Extending south from the main subway and joining it at grade will be another subway 25 ft. wide and 17 ft. high, which will branch at right angles, one branch running to the power house and the other to the express buildings. Running along the east side of the basements of the latter there will be a subway 12 ft. wide by 18 ft. high which connects with the main subway at the west end.

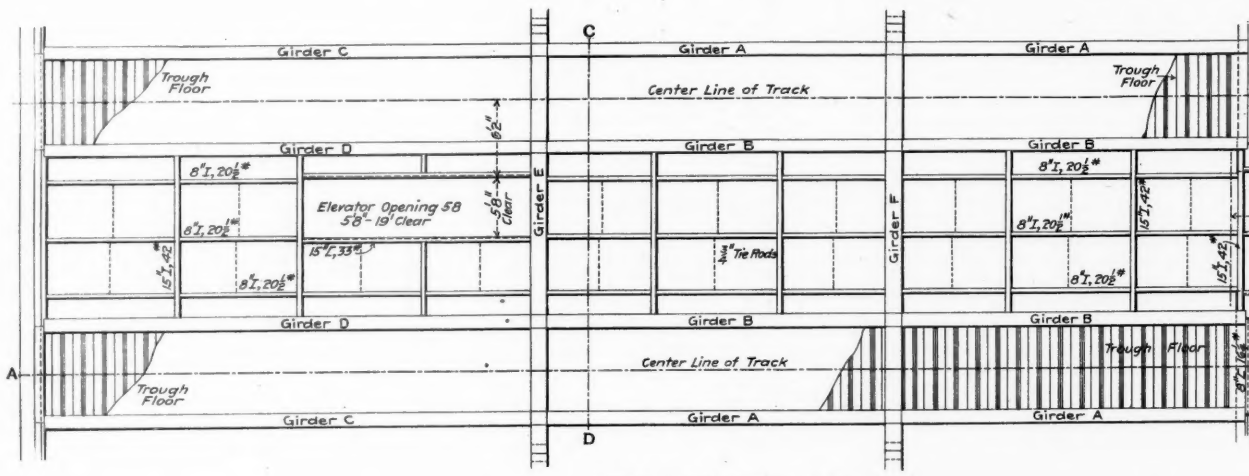
The approaches to the main subway are to be open cuts, that on the east side, in Eighteenth street, having a 4.25 grade, and the one on the west side about the same. The Eighteenth street approach will be longer than the Twentieth street, and will join the subway at right angles. As the latter approach is restricted for room, it would be impossible at the allowable grade to obtain sufficient head-room under the proposed baggage house, should the subway be joined at right angles; for were this to be done it would require supporting girders, for the building, of 60 ft. span and only 18 in. deep. The approach will therefore be carried farther south and swung into the subway on a curve.

The main subway will be divided into three bays, the north one of which will be 40 ft. wide, the middle one 30 ft., and the south one 28½ ft.—a total width of 98½ ft. between walls. As will be seen from the plans, the clear head-room is to be about 12 ft. 3 in. for the north span, 14 ft. 1 in. for the middle, and 14 ft. for the south span. The girder for the widest bay will have an effective depth of 63½ in.; the other two will each be 40 in. These cross girders will be riveted to the longitudinal girders, the north, or heavier, of which will be 62½ in. deep, and the other 61½ in.

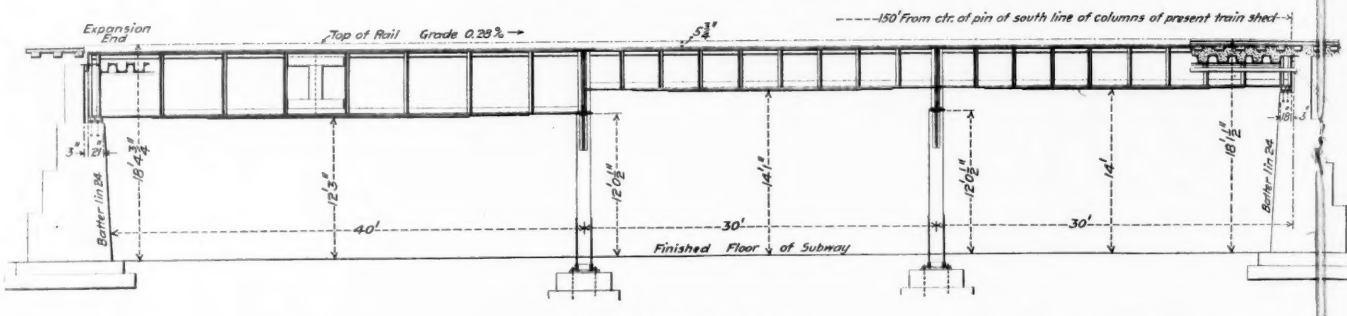
The supporting columns for these girders will be spaced



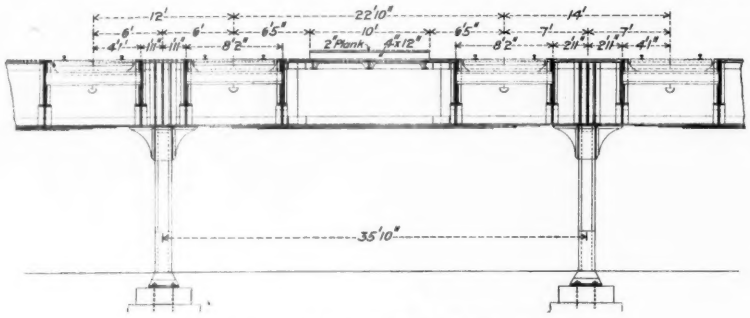
East End of Yard; Tracks Leading to Eads Bridge (Through Tunnel) and to Merchants' Bridge Over Elevated Tracks.



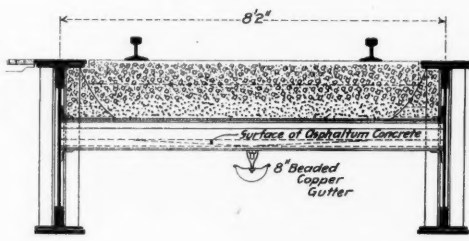
Typical Framing Plan of One Panel.


Expansion End
Top of Rail Grade 0.28%
150' From ctr. of pin of south line of columns of present train shed
Batter 1 in 24
40'
30'
30'
Finished Floor of Subway
Batter 1 in 24

General Cross Section A-B.

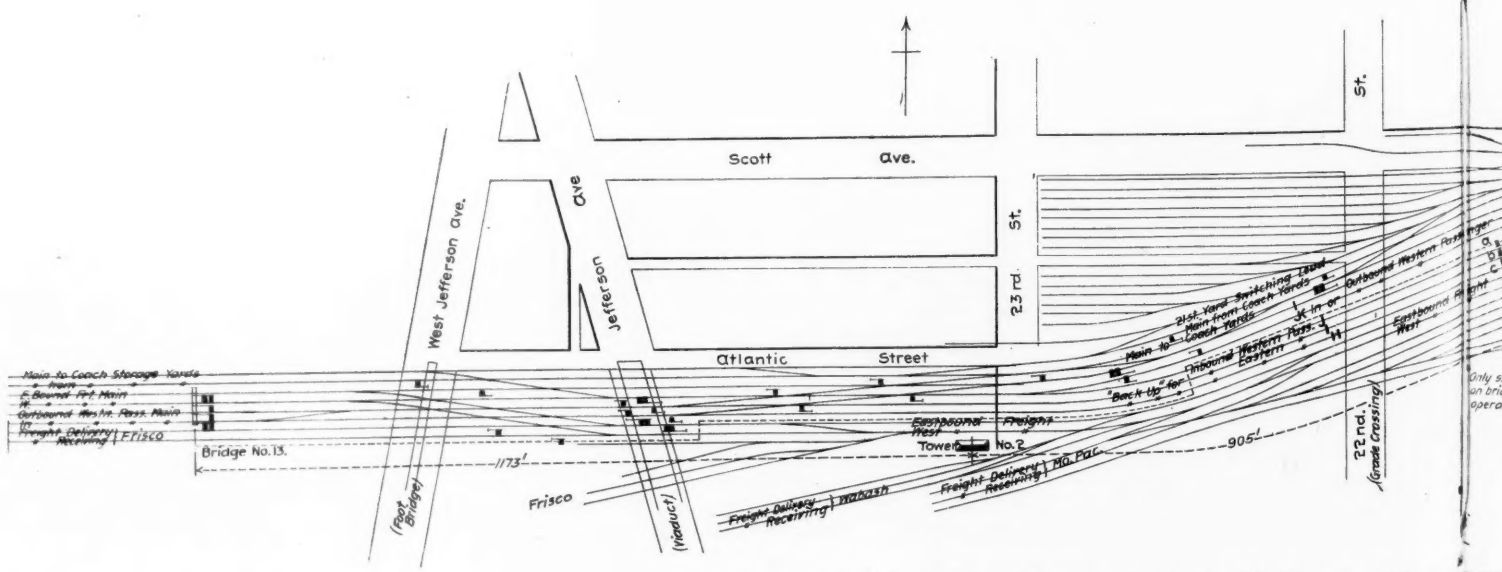


General Longitudinal Section C-D.

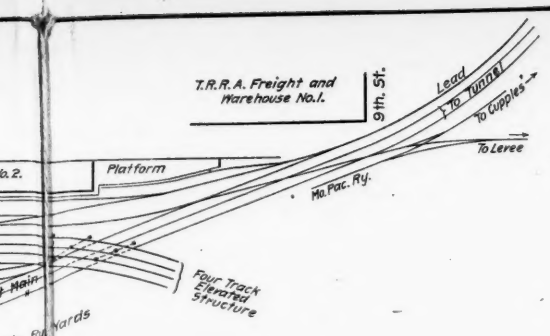


Sections Showing Details of Trough Floor.

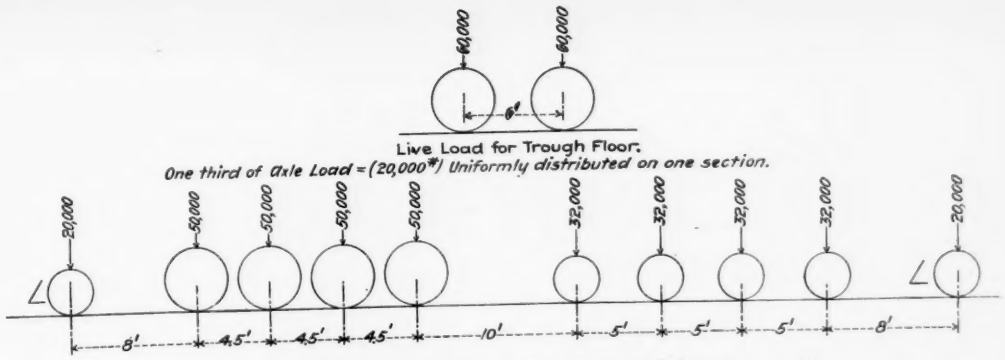
Plan and Transverse and Longitudinal Sections of Structure to Support Tracks Over Subway.



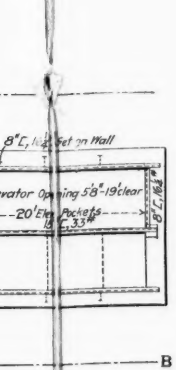
PLAN OF TRACKS IN THE ENLARGED STATION AND YARD—UNION STATION

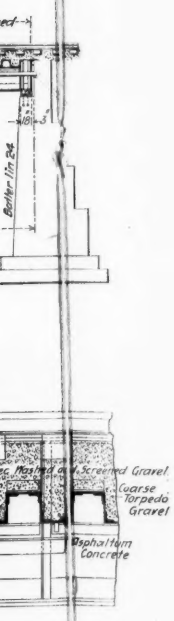


ed Tracks.

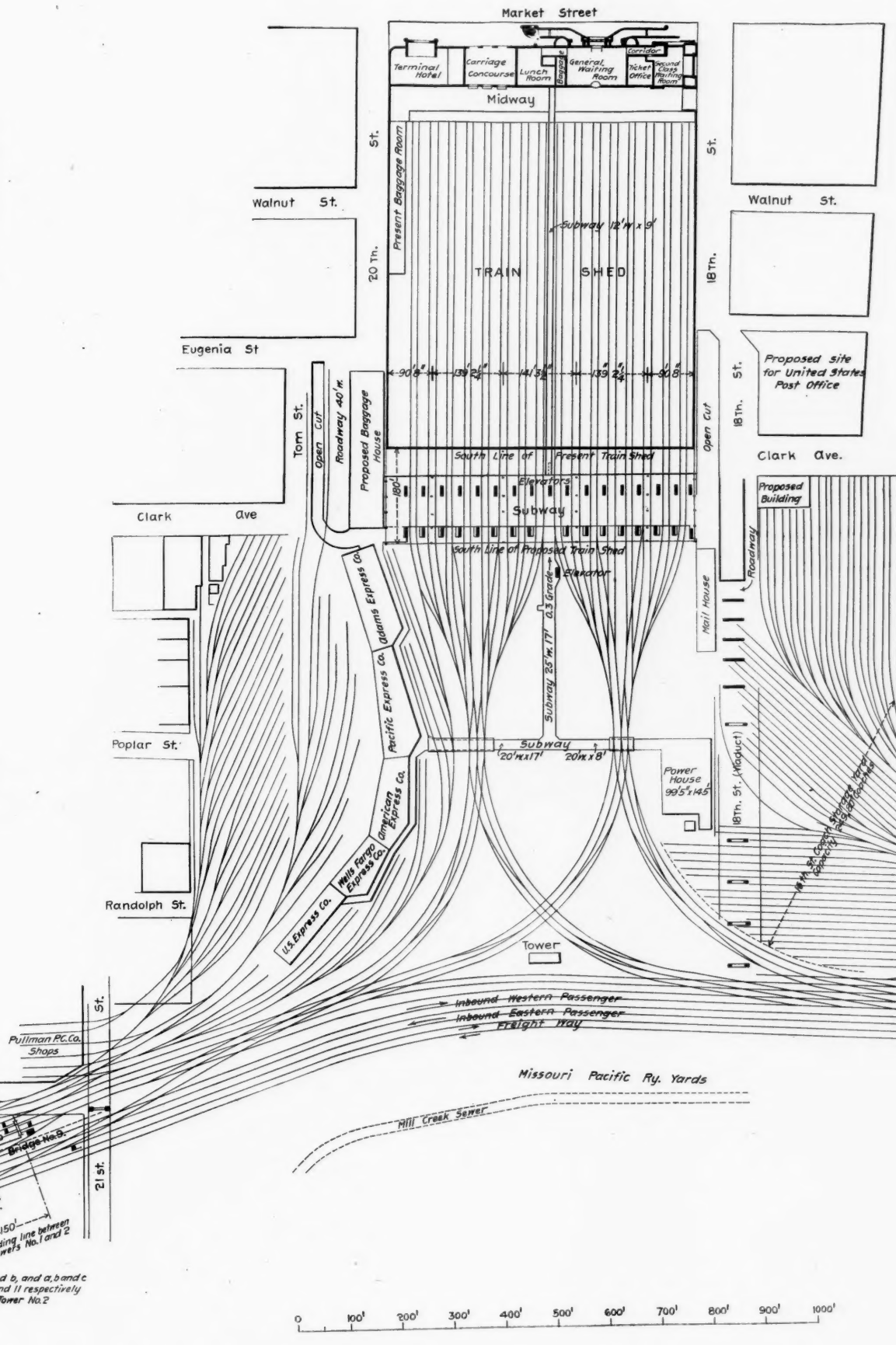


Load Diagram for Tracks Over Baggage Subway.





Floor.



ION STATION, ST. LOUIS, MISSOURI—TERMINAL RAILROAD ASSOCIATION OF ST. LOUIS.

35 ft. 10 in. centers, and it will be noted that the north row of these is to be coincident with a row of columns of the proposed train-shed extension of 180 ft. Where these columns occur they will be carried through, making a continuous column from subway grade to roof truss. The total load on these columns will be 1,077,000 lbs.—546,000 lbs. being live load, 278,000 lbs. roof load, and 253,000 lbs. dead load of subway structure. The foundations for these columns will be of concrete, 8 ft. deep, with a bearing of 12 x 15 ft., and with a granite cap 18 in. thick and 5 ft. 8 in. square. They will rest upon 30 piles, spaced 2 ft. 3 in. centers. The intermediate columns on this row will have 12 ft. x 12 ft. foundation, of the same depth as the others, and will rest upon 25 piles. The south row of columns will have 16 piles. From all of the above should be excepted the end columns, which will have but 10 piles, with a 11 ft. x 15 ft. bearing.

The trough floor, supporting the tracks and platforms, will have an effective depth of 7.2 in. The troughs are to be placed parallel to the longitudinal girders or at right angles to the tracks. Each trough will have its bottom guttered with asphaltum concrete, graded to slope from the ends and sides to the center. A 1 in. galvanized pipe nipple, screwed into the trough at this point, will drain the moisture into a copper gutter, swung to the troughs by galvanized iron hangers. Above the asphaltum concrete there will be a filling of coarse torpedo gravel, the whole being overlaid with Meramec washed and screened gravel, in which the ties will be bedded.

The walks between trains will be of 2 in. plank, laid on 4 in. x 12 in. sleepers. The subway floor is to be of concrete finished with asphaltum.

Work on this subway is now under way, excavating being in progress. During this time the tracks will be carried upon timber falsework, of 14-ft. panels, three piles to the panel. Preparatory to driving these piles a diagram was made, carefully locating each pile. Temporary tracks have been laid to the west end of the subway, from which end the work started, and the material is being removed in cars.

For the largest of the lateral subways and its east and west branches it is probable that skylight construction will be used overhead except under the track floors. Where the east and west branches pass under the throats of the leads, a trough floor, 52 ft. wide under the east lead, and 126 ft. wide under the west lead, will be put in. The troughs will carry the entire load. They will be made of 4 in. x 4 in. x ½-in. angles, 20 in. x ½-in. web plates, and 15 in. x ⅝-in. top and bottom plates.

It has been mentioned that the smallest lateral subway would be used for trucking valises from the baggage ticket office to trains. In addition the heating and water pipes, pneumatic tubes and electric wires will be put in it. The pipes will be carried across the main subway and into the large lateral for a distance of 124 ft., through openings in the girder webs, 4 ft. 8 in. x 2 ft. 3 in. At the point above mentioned they will run onto offsets built in each wall of the subway. The largest pipes will be 12 in. in diameter.

It will be observed that one of the south row of elevators is to be placed in this subway some distance from the line of the others. Should it be placed in line it would block the subway, hence the displacement. An umbrella shed will be built out to it from the train-shed.

The well which is seen on the west side of the large lateral subway is to receive the drainage from the elevator pits, which are 6 ft. below the subway floor, and are surrounded by wing walls. Sewer connections from these latter are carried on a .3 grade to the well, the bottom of which is 10 ft. below subway grade. As the sewer at this point is just about at the subway level, two ejectors will be put in the well to raise the contents into the sewer.

The Twentieth street sewer presented one of the numerous difficulties encountered, as the elevation of the subway floor will come about 7½ ft. below the top of the sewer in Eugenia street. It will therefore be necessary to lower the top of that section of the sewer which will pass under the basement of the baggage house and the subway, at the same time preserving the sectional area, and a sufficient grade. The section requiring alteration is approximately 640 ft. long. Under Eugenia street, just north of the baggage house, the sewer is ovate in section, the long diameter being 8 ft. and the short diameter 7 ft. At this point, in order to reach the necessary level to pass under the baggage house, a tumbling basin is to be put in, giving a change of elevation of 4.7 ft. As the sewer passes under the building its section will be changed into that of a very flat ellipse having the ends cut off. The construction is to be of concrete with a 4-in. lining of brick—vitrified at the bottom, and common at the top. The tumbling-basin steps will be of granite.

The sewer passes under the west wall of the Adams express building, making an angle of about 18 deg. with it. The building wall is to be supported at this point by a concrete beam of 70 ft. span. It will be trapezoidal in section, 13 ft. 8 in. deep, 2 ft. 10 in. at the top, and 5 ft. 6 in. at the base, and will be reinforced by 194 steel rails 30 ft. long.

The mail house, which at present is on the west side of the shed, and is small, will be moved to the opposite side and enlarged to approximately three times its present area. It will be fire-proof, and have two stories and a basement; possibly three stories. The proposed site for the new post office is just across the street from the train-shed, and connection between this and the mail house will doubtless be by subway. The mail house basement is at grade with, and adjoins, the entrance to the main subway. As already mentioned the south row of elevators will be used for mail as well as express.

The express buildings will be moved from the east to the west side of the leads and located as shown. These buildings, which will be of mill construction, will each have a basement and two stories, except the Pacific, which will have three stories. The basements will, of course, be at grade with the adjoining subway, and elevators will serve the several floors. On the tracks in front of the buildings there will be room for seven cars for each of the first three buildings (four on one track and three on the other), five for the next, while the tracks serving the last will accommodate nine. Suitable platforms are to be built between these pairs of tracks.

The tracks just west of the express buildings are to be used for cars loaded with theatrical scenery, milk cars, etc.; they are laid out in pairs, with 10 ft. roadways between pairs, making cars on any of the tracks readily accessible by wagons. The storage yards east of the leads are to be greatly enlarged. These are for both freight and passenger cars.

The power house, now under the interlocking tower, will be moved to the east side of the leads. It is to be of fire-proof construction, 99½ ft. x 145 ft., with a pump room 29 ft. x 29 ft. adjoining. There will be a basement and one floor. This house heats the station, the heating being done by exhaust steam. It lights the station, train-shed, outlying buildings, and the yards 1½ miles west and one mile east, alternating current apparatus being used throughout. It will also supply power for a coaling station and transfer tables, and for charging storage batteries on electric lighted trains.

East of Fourteenth street three engine houses of rectangular plan for foreign engines are to be built, with transfer tables between, and another at the east side of the east house. The pits between the houses will each have two tables, a total of five tables to serve the three houses. This will provide ample facilities at all times for quick handling of the engines; the capacity of the three houses will be 65 engines.

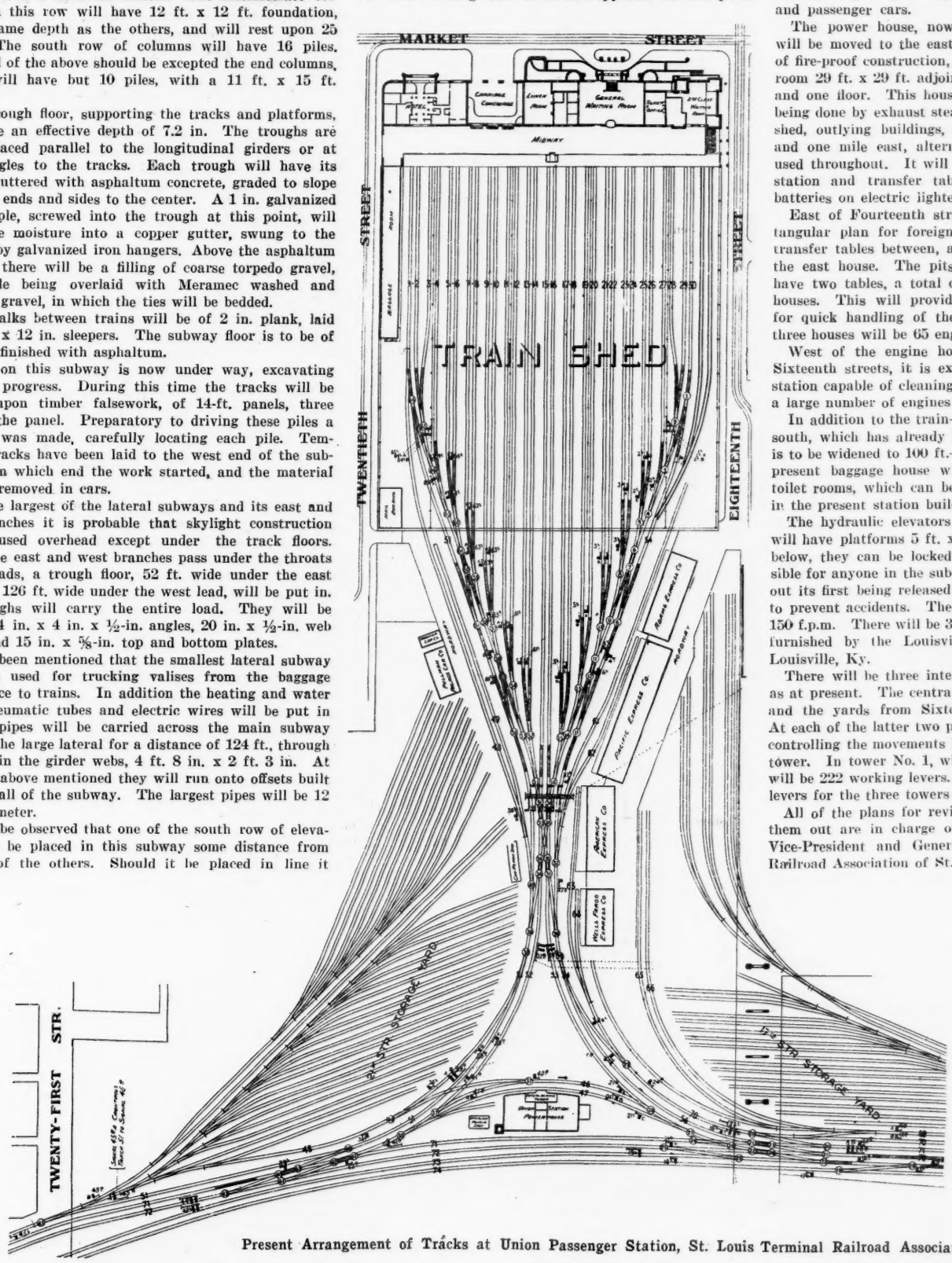
West of the engine houses, between Fourteenth and Sixteenth streets, it is expected to build a large coaling station capable of cleaning, coaling, watering and sanding a large number of engines at one time.

In addition to the train-shed extension of 180 ft. to the south, which has already been mentioned, the "Midway" is to be widened to 100 ft.—double its present width. The present baggage house will probably be converted into toilet rooms, which can be made much larger than those in the present station building.

The hydraulic elevators for baggage, mail and express will have platforms 5 ft. x 19 ft. Though operated from below, they can be locked from above, making it impossible for anyone in the subway to lower the elevator without its first being released from the train-shed floor; this to prevent accidents. The speed of the elevators is to be 150 f.p.m. There will be 39 altogether, and they are to be furnished by the Louisville Foundry & Machine Co., Louisville, Ky.

There will be three interlocking towers instead of one, as at present. The central tower will control the station and the yards from Sixteenth to Twenty-third streets. At each of the latter two points there will be a tower for controlling the movements beyond the limits of the central tower. In tower No. 1, which is the central tower, there will be 222 working levers. The total number of working levers for the three towers will be 349.

All of the plans for revision and the work of carrying them out are in charge of Mr. W. S. McChesney, Jr., Vice-President and General Manager of the Terminal Railroad Association of St. Louis. The details have been worked out under the direction of Mr. Daniel Breck, General Superintendent, assisted by Mr. J. L. Armstrong, Engineer of Maintenance of Way. To these officers we are indebted for the data for this article.



Present Arrangement of Tracks at Union Passenger Station, St. Louis Terminal Railroad Association.

Foreign Railroad Notes.

The new Atlantic-type engine for the Paris-Orleans line in France will weigh about 75 tons and have a total heating surface of 2,600 sq. ft. It is possible that the Sud Express may be increased in weight to 180 tons and the speed increased.

The Midland Railway will put track tanks on the line to the north, which will make it possible to run from London to Leeds, 196 miles, and from London to Manchester, about 185 miles, without stops. The Midland is the last of the important northern lines to introduce this time-saving appliance.

RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856.
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EDITORIAL ANNOUNCEMENTS.

CONTRIBUTIONS.—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussion of subjects pertaining to ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

The office of the Railroad Gazette is now at 83 FULTON STREET, at the corner of Gold Street, east of Broadway.

"Labor unions should be required to organize legally, like other individuals who associate for a distinct industrial purpose, so that responsibility may attach to their conduct." This is quoted from Professor Bolles' article in the *North American Review* for March and it seems not obviously true. The American Express Company, the Adams Express Company, are not incorporated, but nevertheless full responsibility attaches to their conduct, and stocks of both are quoted at more than double par. The Boston, Hartford & Erie railroad was thoroughly incorporated and its stock certificates may still be bought at a fair rate per pound. Responsibility is to a greater extent a question of fact than a matter of form. "The Clothing Cutters' and Trimmers' Assembly, No. 7507, Knights of Labor," duly incorporated themselves in Maryland under a special provision of the general corporation law of the State. These "knights" were so unchivalric as to force the discharge of a non-union man and the courts compelled them to pay him $2,500 for loss of wages and for smart money. Their incorporation, however, was neither a help nor a hindrance; it was the attachment of their bank account which produced results. The lack of incorporation of the brotherhood did not for a moment keep Judge Adams, of the United States District Court at St. Louis, from enjoining them from interference with the Wabash employees. Not one, probably, of the 16 trade unions involved in the street car strike at Waterbury, Conn., is incorporated. They are boycotting, terrorizing, maiming and killing, and, far too late, Judge Elmer, of the Superior Court, has enjoined them, and, in the civil suit, has attached the bank accounts of all known to be connected with these 16 unworthy organizations for promoting the cause of labor. It is not yet shown that the existing law is defective in failing to afford full protection to railroads from outside interference. It seems, rather, that railroad officers have not fully availed themselves of the protection of the law.

One of the great advances which has been made in the last 10 years in shop practice is the introduction of electricity for driving machine tools. It appears, however, that the full benefits to be derived from the introduction of such a system are not generally appreciated. While it is true that in antiquated shops the cost of fuel for driving tools and machinery may be a large percentage of the total cost of the product, it is nevertheless a fact that in most shops the cost of fuel is insignificant compared to the cost of labor and material. In a certain machine shop and foundry the cost of labor is about 47 per cent. of the total cost of the product, the cost of the raw material is 50 per cent., and the remainder (3 per cent.) is chargeable to the fuel account. It is the increased output that makes electricity superior to other means of shop driving. Unless, however, the present machine tools are re-designed and made heavier, so as to carry the increased cuts which are now possible by reason of the development of high speed tool steels, the advantages of electricity may not be fully realized. The electric motor is a simple and efficient means of driving the machine tool and it also makes possible quick and efficient variations in the speed of the machines. Other devices might be made that would serve the same purpose, but it is extremely doubtful if the workman would vary the speed every time the work demanded, unless it could be done without much trouble or physical exertion, as is the case with the motor drive.

The Rise and Decline of the White-Pine Traffic.

For thirty years the trade journal now known as the *American Lumberman* has collected and published elaborate statistics of the production of white-pine lumber in the United States territory adjacent to the Great Lakes—that is, in the States of Michigan, Wisconsin and Minnesota—from which the great prairie States have always obtained their supplies of this timber, which until a comparatively late date was almost their sole building timber. These accumulated statistics now present a history of one of the greatest industries of the country, showing its rise, fluctuations and decline—an industry which rendered possible the rapid development of the immense and fertile prairie country in the upper Mississippi Valley, and has been directly one of the great wealth-producers of the country. We do not sufficiently credit the natural resources of the country, accumulated without effort on our part in past ages, as in mines, or in past centuries, as in forests, when we wonder at the rapid growth of our country. Here in these three States within the last thirty years we have harvested a crop, which had taken more than a century to grow, of 188,391,000,000 ft. of lumber, not counting lath and shingles—worth more than the wheat crops of those three States, and costing vastly less to harvest and nothing to cultivate. To the carriers this crop has afforded a tremendous traffic, and to those in the lumber regions it was long their chief and often almost their only support. And with the exhaustion of the forests, plainly shown in some of these statistics, many railroads have suffered a revolution in their traffic, disastrous or otherwise according to the nature of the resources left when the pine had been cut.

The pine lumber production in this entire district increased with great rapidity after the war and reached 3,994 millions of feet in 1873. The prostration of business which began in the last quarter of that year and continued until 1879 was manifested in the lumber trade by a cessation of growth rather than any marked decrease in production, which was natural; because the chief cause of the crisis in 1873 was probably a great over-production of railroads, chiefly in the prairie country, which could not grow at all (and it grew very slowly then) without lumber. For the five years after 1873 the average yearly production was 3,765 millions. The return of prosperity is by nothing better shown than in this industry, the yearly production in millions of feet, having been for five successive years:

1878.	1879.	1880.	1881.	1882.
3,629	4,807	5,651	6,769	7,552

The doubling of the production within five years was due not only to the greatly increased demand, but to the building of railroads through pine forests, which lacked streams by which logs could be floated to mills and navigable waters.

The production of 1882 was not largely increased for five years, in which (1883 to 1887, inclusive) the yearly average was 7,559 millions. It should be remembered that the production is limited not only by the accessible standing pine and the capacity of the mills, but also by the weather, which is sometimes favorable and sometimes very unfavorable for the "log crops."

After 1887 followed a period of five years which doubtless remain for all time the period of greatest production, averaging 8,302 millions per year, but once falling below 8,000, and reaching, in 1892, 8,591 millions—the greatest in the history of the industry.

We have now reached the period of the decline of the white-pine lumber industry. Doubtless, the general decline in business which began in 1893 made the decrease greater at first; that is, there would have been a greater supply then had there been a demand for it. From the 8,594 millions in 1892, the production fell to 7,326 in 1893, and 5,725 in 1896. The course of the production since has been as follows:

1897.	1898.	1899.	1900.	1901.	1902.
6,233	6,155	6,056	5,485	5,336	5,294

The last four years of this period have been a time of extraordinary and increasing business activity; the population of the territory which is supplied with this lumber has been increasing constantly and is now much larger than in the time of maximum production (1888-92), but instead of the 8,302 millions per year produced then, and the average of 6,731 millions in the bad four years from 1893 to 1896, and of 6,148 in the three years of recovery, ending in 1899, we have an average of but 5,372 millions in the last three years of extraordinary trade prosperity—35 per cent. less than in the previous prosperous period which ended only ten years ago. There are now more people who want lumber and they are better able than ever to buy it; but it is no longer possible to supply them with white-pine at the old rate.

The exhaustion of the supply, however, is shown much more plainly by local statistics of production. The *Lumberman* has always reported it for three separate districts, the "Chicago district," intended originally to include mills whose product was marketed almost exclusively through Chicago (or Milwaukee), being those on both shores of Lake Michigan and Green Bay and most of those in the upper peninsula of Michigan; while east of it is the "east of Chicago district," lower peninsula of Michigan except the Lake Michigan mills; while the "west of Chicago district" includes Wisconsin except Green Bay, Minnesota and the mills on the Mississippi, which get their logs from these States.

Now the "east of Chicago" district produced 1,414 millions (35 per cent. of the whole) in 1873, reached its maximum of 2,432 millions (32 per cent. of the whole) in 1882, declined to 1,878 millions (22 per cent. of the whole) in 1892, the year of maximum total production, to 976 millions in 1897, and since then has declined as follows:

1898.	1899.	1900.	1901.	1902.
867	505	381	312	165

So that in the last year it is hardly worth considering, producing little more than 3 per cent. of the total, and not one-eleventh as much as it did in 1892.

In the "Chicago district" the course has been similar, if not quite as rapid. The production then was 1,227 millions in 1873, rose to its maximum, 2,481 millions, in 1889, and since 1892 has fallen almost uninterruptedly to 801 millions in 1902—less than one-third of its maximum and but 15 per cent. of the total production.

Thus the "west of Chicago district"—Wisconsin, west of the Green Bay mills, and Minnesota, which was last to be developed and markets chiefly by rail directly from the mills—is now the only great producing district. It yielded 1,353 millions in 1873, 3,449 in 1884 (41 per cent. of the whole) and reached its maximum (4,401) only in 1899, though it produced nearly as much in 1892. The prairie market now belongs to this district, and its production has been comparatively steady for the past 13 years, and has increased slightly since 1900. It probably contains now but few large bodies of standing pine which have not been made accessible by railroads or other means of transportation, and no considerable increase in production is probable without an important rise in price. This production is still greater than the total of the three districts in any year previous to 1879; but it has already, apparently, reached its maximum, and in many parts of the district it has been declining for years. For instance, the mills on the Wisconsin Central Railroad produced 356 millions of feet in 1889, never less than 300 until 1893, an average of only 80 millions for the last six years, and 64 millions last year; so the Chippewa Valley, from an average of 309 millions in the five years ending in 1893, has fallen to an average of 163 in the last two years; and there is a very much larger decrease in the Mississippi River mills below Minneapolis; while what are known as the "Duluth" and "Ashland" districts alone show an important increase in production.

The decrease on some of the Michigan railroads amounts almost to a disappearance. The Pere Marquette Railroad mills produced but 3½ millions last year, against 193 in 1891; the Grand Rapids and Indiana 27 last year against 231 in 1889, etc.

One of the results of the exhaustion of the pine has been an increased use of other woods, part of which comes from the same territory. The cut of hemlock, formerly so small that it was not thought worth recording, last year was nearly one-fourth as great as the white-pine cut; in the "east of Chicago district" it was nearly twice as great. The Wisconsin Cen-

tral mills, which cut but 62 millions of pine last year, produced 167 millions of hemlock and 68 millions of hard wood. There is generally a decrease in the latter for the short time it has been reported, but it is produced over a much wider territory than white-pine.

The country which formerly was supplied with lumber almost exclusively from the northern white-pine district, and used white-pine for almost all purposes for which it could be used, because it was easily got and easily worked, now uses immense quantities of Southern hard pine, and of late years has been receiving shingles and some other lumber from the Pacific coast, which ships other lumber now further and further to the East, because the Pacific railroads, having an excess of westbound traffic, are giving extremely low rates on lumber eastbound, in order to earn something in cars which otherwise must be hauled back empty. Oregon and Washington, west of the Cascades, can produce more lumber than they can market in these days, and the day when their forests will begin to fail is still far off. As far back as 1870 it was reported by men who had studied the matter that the white-pine about the lakes would be practically exhausted within ten or fifteen years, in spite of which we see that the production last year was a third greater than in 1873. But it is none the less true that it is being exhausted, and that rapidly. Michigan especially gives eloquent testimony to the result of the lumbering operations of the past thirty years.

The London & North-Western Policy.

The British transportation journals, accepting the gauntlet thrown by Mr. George Paish, have for some time been engaged in a lively controversy as to British methods of railroad management. The discussion, in general, has been academic in its nature, owing to the inevitable temptation to draw deductions from comparisons of properties worked under dissimilar conditions. Mr. Paish has argued for heavier "waggons," for more complete statistics of operation, for greater conservatism in giving dividends and in charging betterments to capital, and for general renovation of railroad management in Great Britain. His comparisons and illustrations have been largely taken from American practice, and controversial champions have arisen to show that conditions in the two countries cannot be compared, and that no change in British methods is possible or desirable.

Last December the discussion was made specific by the actions of a minority party of London & North-Western stockholders, who were dissatisfied with the reduced dividend which had been paid, and with the consequent falling off in the market price of the stock, and who carried their grievances to the London *Times*. A committee of the dissenting stockholders, consisting of W. Burdett-Coutts, Lord Brassey, Geo. Peel, Nath. Spens, Richard Green, and John Gilmour, asked proxies to be used at the February meeting of the company, authorizing the committee to question and practically to supervise the directors. The complainants alleged that they had vainly sought information from the management in regard to certain facts about the handling of their property, and they desired, for the welfare of the railroad, to bring about a combination of interest with some of their competitors, and to secure better loading and American statistics.

The action of the board was not criticizable in one respect—the division of net earnings—for the stockholders got them all. The net earnings were £5,253,098 and the dividends were £5,225,581, which practice was quite un-American, but not necessarily incorrect.

On Dec. 18, Lord Stalbridge, Chairman of the Board, addressed a communication to the stockholders requesting them not to pledge themselves until the views of the Board on several points had been explained. He subsequently issued a circular, in which attention was called to the fact that the leading mover in the committee was largely interested in a stock brokerage firm; that the directors were ready at all times to answer inquiries from stockholders, so far as was consistent with the interests of the property, and that all reasonable efforts were made to modernize the service. The sentiment of the semi-annual meeting was strongly in support of the management; vigorous objections were made to the proposition that the directors should openly advertise their methods, and laughter was caused by the intimation that the committee wished the directors to become bees in a glass hive, so that everybody could see how they were working. The vote taken was practically one of confidence, and the committee was left without ground to stand on.

Thus ended a picturesque incident, interesting chiefly as showing the activity of British stockholders and the stability of British railroad management.

Delaware & Hudson.

The effect of the anthracite coal miners' strike on the business of this great coal carrier was what might have been expected. The gross earnings, which were $12,178,683 in 1901, decreased $1,127,994, to $11,050,689 in 1902. The operating expenses were $6,460,983, an increase of $317,496, leaving net earnings of $4,589,707, a decrease of $1,445,488. The total amount of coal produced in the anthracite regions, dropped from 53,568,601 tons in 1901, to 31,200,890 in 1902. Of this total, the Delaware & Hudson and the Hudson Coal Co. properties produced 3,127,697 tons. The total anthracite transportation over the Delaware & Hudson's lines during the year was 4,640,772 tons, a decrease of 2,930,526, and, as a result, the freight earnings decreased $1,376,514, while earnings from express, mail and passenger traffic increased $240,903. The increase in operating expenses is due to the policy of continuing large maintenance appropriations, notwithstanding the decrease in earnings. The charge for maintenance of way, and structures, was $1,354,080, which is $1,821 per mile of road; and for maintenance of equipment, $1,243,637. New equipment was purchased costing $1,158,172, which sum is to be gradually absorbed by the operating expenses, a fixed amount being charged thereto, annually. The capital stock was decreased from $34,648,700 to $34,507,100 by the retirement of $138,600 of stock.

The total number of miles of road operated during the year was increased from 660.8 to 717.8, by the acquisition of 56.97 miles of single track of the Adirondack railroad.

Statistics of operation follow:

	1902.	1901.	Increase.
Passengers carried.....	6,074,613	5,703,635	370,978
Millions tons frght. 1 mile	1,159,831	1,274,511	*114,679
Passengers 1 mile.....	103,827,273	95,835,051	7,992,222
Ton miles per mile.....	1,682,598	1,928,653	*246,065
Pass. miles per mile...	150,625	145,022	5,603
Av. freight haul, miles.	108.81	97.6	11.2
Av. pass. haul, miles...	17.09	16.8	.29
Total pass. revenue....	$2,371,966	$2,160,754	$211,212
Total freight revenue...	$8,240,858	$9,617,372	*$1,376,515
Freight train miles.....	3,357,255	3,586,489	*229,234
Av. freight train load..	345.47	355.36	*9.89
Miles operated	717.80	660.83	56.97
Per cent. exp. to earn..	58½	50½	8

*Decrease.

Missouri Pacific.

During 1902, the average train load on the St. Louis, Iron Mountain & Southern increased from 334.6 tons to 383.9, or 49.3 tons per train, and on the Missouri Pacific division, from 251.4 to 262.6 tons, or 10.2 tons per train. This has been chiefly accomplished through the liberal expenditures which have been made, out of surplus income, after payment of 5 per cent. dividends on the capital stock. In 1901, $2,350,686 was thus appropriated out of income account for betterments and equipment, and during 1902, $2,623,621 was appropriated, making a total of $4,974,307 for the two years, in addition to which, $1,000,000 was reserved toward payment for similar improvements during 1903. The appropriations were made with a direct view to the increase of net income, either by means of reduced cost of transportation or by furnishing facilities to handle an increased traffic, and have resulted in practical rebuilding of large portions of the company's lines, especially the main lines of the Iron Mountain, and the Missouri Pacific between Osawatomie and Deering Junction, Kan., and between Lake City and Boonville, Mo.

Of the income thus applied, in 1902, $888,161 was spent for grade reductions; $617,822 for new side tracks; $325,116 for new shops (principally at Baring Cross, Ark.); $608,132 for excess weight of heavy rails over rails replaced, and for the excess of cost of new bridges over the maintenance charge necessary to have renewed the old structures, and $184,391 for other expenditures, not classified. This is, of course, exclusive of the maintenance sums charged to operating expenses. For maintenance of way, $4,621,700 was spent on the Missouri Pacific, the Central Branch, and the St. Louis, Iron Mountain & Southern. This is at the rate of $818 per mile, for the 5,649 miles of line worked. Combining the maintenance charge with the special appropriations out of net income, it will thus be seen that about $1,283 per mile was spent on the line during 1902.

Gross earnings for the system increased from $36,661,094, in 1901, to $37,495,688, in 1902, an increase of $834,594, but this was offset by an increase of $1,427,676 in operating expenses, which amounted to $25,043,191, in 1902. The resultant net earnings were $12,452,497, in 1902, as against $13,045,579, in 1901. The increase in operating expenses is partly accounted for by the obstruction to traffic occasioned by the rebuilding of portions of the line; by the failure of the 1901 corn crop, which was reflected in the movement of traffic during 1902, and by other adverse circumstances, such as the burning of the shops at Baring Cross, which increased motive power expenses. Looking ahead to the coming season, the abundant crops of 1902 give prospect of a much larger grain movement during the present year, and a portion of the benefit from the betterment of the line, as exhibited in decreased transportation expenses, is expected to appear, although the full benefit is not expected to be shown until 1904 and ensuing years.

The sum of $4,396,339 was spent on surveys and the construction of new lines, $1,288,150 going to the White River branch, running diagonally across Kansas; $1,185,498, to grade changes on the Little Rock & Ft. Smith, and the balance distributed among 10 other pieces of work, exclusive of miscellaneous surveys. On these new lines, 175 miles of track were laid and grading completed on 140 miles additional, at the close of the year. Equipment purchased, at a total cost of $4,156,587, included 95 locomotives and 3,336 freight cars. The greater part of the money thus spent, to a total of $3,815,750, was furnished by the Missouri Pacific Equipment Association and by the Iron Mountain Car Trust. Payments to the former run from 1903 to 1912, inclusive, at the rate of $203,000 yearly. On the Iron Mountain Car Trust there is at present $2,829,000 outstanding, payable from 1903 to 1911, inclusive, in such a way that the annual monthly rate is $26,943.

Statistics of freight traffic during the year show a decrease in lumber, live stock, grain, and unclassified articles, and a gain in coal and in manufactures and merchandise. The latter, constituting 16.6 per cent. of the total traffic, as against 11.8 per cent. for the year previous, was the most important change which occurred. This more than offset the decrease in grain from 16.3 per cent. in 1901, to 12.9 per cent. The total number of ton-miles of revenue freight was 3,324,575,602, an increase of 90,353,707, or 2.8 per cent., but the average ton-mile rate decreased from 8.25 mills to 8.07 mills. Total freight earnings, however, were $33,071,776, an increase of $141,305.

NEW PUBLICATIONS.

The Manufacture and Properties of Iron and Steel.—By Harry Huse Campbell, General Manager of the Pennsylvania Steel Company. New York: The *Engineering and Mining Journal*. Second edition. 862 pages; price $5, postpaid.

This book has been carefully revised and rewritten and is about twice the size of the first edition. New chapters on the blast furnace, the open-hearth, and the use of fuels as well as the Bertrand Thiel and Talbot methods, have been added. A new departure is the description of each separate important iron producing district in the world. The book is divided into three parts: The Main Principles of Iron Metallurgy, The Metallurgy of Iron and Steel, and The Iron Industry of the Leading Nations. The first part is written in a concise and pithy style and anticipates much that is afterwards taken up in detail in the body of the book. The sub-divisions include the making of pig iron, making of wrought iron, definition of steel, making of crucible steel, acid Bessemer process, basic Bessemer process, open-hearth processes, segregation, influence of hot working on steel, effect caused by changes in the shape of the test piece, influence of certain elements on steel, specifications on structural materials, welding, steel castings and inspection.

The author is decidedly in favor of the acid process of making steel and gives as one of his reasons that it takes more carbon to give a certain tensile strength in basic steel than in acid steel. This is objectionable, as every increase in the carbon content gives a better chance for segregation and lack of uniformity. He objects to the common practice of writing specifications calling for steel of certain tensile strength and also limiting the allowable percentage of carbon, phosphorus, manganese, and sulphur. The slightest consideration shows that it is impossible for the engineer to limit both the chemical and physical properties and yet obtain the desired results. It is right for the engineer to specify certain parts of the chemical formula but considerable leeway must be left the manufacturer. If the phosphorus limit is specified, then the carbon should be left open, and vice versa. The making of steel was "once a trick; then an art, but is now a business," and due consideration should be given this fact.

By an ingenious application of the theory of least squares to a large number of experiments with acid and basic steel, the author has deduced linear equations showing the most probable physical properties for certain combinations of the principal elements. It is stated that an increase of one hundredth of 1 per cent. in phosphorus increases the tensile strength about 1,000 lbs. per sq. in., but also increases the brittleness. A similar increase in the carbon content has a like effect on the tensile strength, but the brittleness is not increased to the same extent.

Under the heading of "Welding" the rather startling statement is made that a weld is "better than nothing, and while it may have half the strength of the bar, and may have its full strength, it does not have its toughness and is unfit to use in any place where failure will be dangerous."

The theory and practice of blast furnace work is reviewed at length. The possibilities of the gas engine for utilizing the waste products of combustion, are pointed out and it is shown that a furnace producing about 300 tons of pig iron per day furnishes enough gas to operate 4,200 h.p. of gas engines. This is sufficient to operate the blowing engines, converting plants and rolling mills necessary to finish that quantity of material. The general use of gas engines is yet in its infancy and there are still many mechanical difficulties in their design to be overcome.

Some of the faults in modern methods of inspection are pointed out. The statement of facts and the deductions are impartial and the author appreciates the position of the inspector and upholds him in not accepting anything which falls without the limits which either "wisely or foolishly" have been set by his principal. Possible mistakes in specifications should call for exceptional discretionary powers and good judgment on the part of the inspector, and that individual should have a good general and detail knowledge of the subject. In the words of the author, what the honest business man wants is "a thoroughly competent inspector who knows how to make sure that he is getting what is called for; who may examine a turn-buckle with a magnifying glass, but pays less attention to an angle for a hand railing; who hammers a fire-box sheet until he knows it is right, but is a little lenient with a gusset plate." The author also objects to the practice of inspecting material at other places than the mills.

The work indicates great labor and study by the author,

and it gives the present status of that important industry —the making of iron and steel—in a comprehensive and understandable way. The volume should be of equal interest to the layman, chemist and engineer.

TRADE CATALOGUES.

The American Blower Co., Detroit, Mich., has a two-page circular showing a large half-tone engraving of the Colorado & Southern 35-stall engine house at Denver, which was described in the *Railroad Gazette*, June 15, 1900, page 394. The engine house is heated and ventilated by the "A B C" fan system, the plan view showing the heating apparatus, situated opposite the 18th stall. By opening or closing certain doors it is possible either to use fresh air, or re-circulate the air within the house. The brick duct for distribution from the fan is 4 ft. sq. at its greatest section, gradually reducing as the extremities are approached. Connection to the pit ends is made by 18-in. tile ducts. A temperature of 65 deg. F. is guaranteed in zero weather. Sufficient air is discharged by the fan to cause a complete change in the building every 20 to 30 minutes. The American Blower Co. is to furnish the heating apparatus for the Canadian Pacific roundhouse at Fort William, Ont.

A new *Map of the World* has just been issued by the Chicago & North Western passenger department. The equivalent projection plan was used in making the map, the effect being to avoid the appearance of condensation in high altitudes. The countries are colored separately, and the latest boundary lines, railroads, submarine cables, etc., are shown; ocean depths are indicated by gradations of color; and steamship lines and railroad routes are shown in a very complete manner. The map is 42 x 64 in., mounted on rollers, and is sent prepaid for 50 cents.

The Edwards Railroad Electric Light Co., Cincinnati, Ohio, and Chicago, has issued a neat pamphlet catalogue of locomotive headlights. The front and back cover designs are adapted to illustrate the distinctive feature of the Edwards light, namely, the vertical beam. The frontispiece is a half-tone from a photograph taken at night, showing two locomotives equipped with these lights, at the entrance to the train-shed of the Chicago union station. The catalogue illustrates and describes in detail the electric headlight apparatus made by this company.

Fireproof Windows.—The Smith-Warren Company, of 253 Broadway, New York, describe and illustrate in a neat pamphlet the Smith system. It comprises hollow metal frames and sashes of sheet steel on copper; cast-iron, or bronze, with fireproof glass. All movable sashes, whether sliding or swinging, close automatically at 153 deg. temperature. The considerable extent to which the system affords fire protection may be easily understood, and, in addition, the work is comely and weather-tight.

"Shakespeare on the Union Pacific Railroad" is the unique title of an attractive little pamphlet that this road is sending out. A. Darlow is the author, and the contents consist of quotations from Shakespeare so selected that they are made to tell the virtues of the cars and the management of the road and the comforts and pleasures of travel. It is a clever production.

Gordon Cells is the title of a 40-page catalogue just issued by the Gordon Battery Co., New York City. In addition to illustrations and prices of the different types of cells made by the company, the pamphlet gives information about primary batteries and directions for setting up and re-charging them.

Mahn & Company, St. Louis, Mo., issue a catalogue showing their engineering, surveying and scientific instruments. There are also some notes on the care of instruments.

The Chicago Pneumatic Tool Co. has an illustrated circular describing its new rock drill and the compression riveter.

Colonel Yorke's Report on American Railroads.

The British Board of Trade has issued [Cd 1,466], the report on his visit to America, extending from Sept. 19 to Oct. 31, 1902, by Lieut.-Colonel H. A. Yorke, R.E., chief inspecting officer of railroads to the Board of Trade. Colonel Yorke directed his attention chiefly to the construction and equipment of: (1) Steam railroads; (2) Tramways, subways, and elevated railroads; and (3) High speed electric interurban railroads.

Col. Yorke discusses at some length the relative advantages of the English and American systems of permanent way. He likes the bull-headed rail and chair; he inclines to prefer the generally prevalent American method of laying rails with broken joints; but he does not like our spikes.

Signaling.—Colonel Yorke says that signaling in America is in an inchoate condition, there being no uniformity of practice throughout the country. . . . Automatic signaling does not of itself introduce greater safety of operation. It is merely a labor-saving device. No doubt it eliminates the risks due to mistakes of signalmen, but it introduces other risks peculiar to itself, due either to inefficient maintenance, to failure of the mechanism, to weather, and to accidents of various sorts. Moreover, the chief object of a system of automatic signaling must be to enable more trains to pass over a given section of the line in a given time, and more trains under such conditions necessarily involve increased chances of accident. . . .

The whole question of automatic signaling requires to be further considered before its applicability to main lines in England can be thoroughly ascertained, and the results of the trials of the system upon the London & South-Western and the North-Eastern Railways will be of the greatest value in the investigation of the subject.

But in "tubes," subways, tunnels, and especially on electrically operated railroads, on which speeds are uniform, junctions and sidings are few and far between, sections short, and which are self-contained, automatic signaling will undoubtedly prove exceedingly useful, and some of the railroads in London now being equipped for electric traction are to be signaled in this fashion.

Power Working of Points and Signals.—The application of some form of power, pneumatic or electric, to the operation of points and signals is becoming a common feature in America at places where large signal cabins are necessary. Such installations, possess many advantages, reducing the physical labor and rendering it possible to employ fewer men. They also economize space and abolish all rods and wires from the station yards. The chief, if not the only, objection to them is their cost, which in the first instance is much greater than that of an ordinary manual plant, and it is simply a matter of calculation whether at any particular place the economies to be derived from such an apparatus balance the initial cost.

Rolling Stock.—Probably the feature of American railroads which at first sight makes the most impression on a stranger is the colossal size of the engines and cars. The newest big engines have great power and are able to haul trains of great weight and length. In America over-bridges are built 18 ft. above rail level, whereas in England the height of such works is as a rule only 14 ft. 3 in. above the rails. Moreover, on double lines in the States the space between the tracks is 7 ft., against 6 ft. in England. It can therefore be understood that we can never hope in England to equal America in the size of our engines or cars. As to the long freight cars used in America, the important factor is not the length, but the carrying capacity of the car in relation to its weight. American freight cars are all carried on bogies, and their carrying capacity varies from 30 to 50 tons, and their "tare" weight from 15 to 20 tons. One of the most popular forms of car at the present time appears to be the 50 ft. steel-framed car with a capacity of 50 tons (of 2,000 lbs.) and a tare of about 20 tons, the total weight per axle being 17 tons 10 cwt. So long as these proportions are adhered to it makes no difference, so far as the cost of transportation is concerned, whether the load is carried in one car with eight wheels or in two cars with four wheels each. That is to say, the result will be the same if, instead of one car of the size and weight mentioned, two cars are employed, each with a capacity of 25 tons and a tare of ten tons, and each having four wheels. Not all the cars in America offer such favorable conditions as those just mentioned. The box cars have as a rule a carrying capacity of 30 to 40 tons and a tare of 16 to 18 tons; the paying load in these cases having a less proportion to the dead load.

There are serious difficulties in the way of introducing for general service in England wagons of great length. . . . The four-wheeled wagon will therefore in all probability remain the standard wagon of the country, and economy is to be sought in improving the design of such wagons and increasing their carrying capacity in relation to their tare, rather than in introducing wagons of greater length.

Couplings.—Col. Yorke says that the coupling mechanism is still far from perfect, especially in regard to the uncoupling attachments. Another common defect in couplers, and one which is the cause of much trouble and expense to the railroads, is the breakage of the knuckle. The Interstate Commerce Commissioners are evidently not satisfied with the couplers as at present used, for the reports say, "It will be seen that the needs of the future in respect to couplers may be described under the heads of strength, simplicity, and finish."

Air-Brakes.—The report of the Inter-State Commerce Commission, published in 1902, contains some severe criticisms on "the present condition of the air-brakes on the freight cars of the country, the lack of thorough training and discipline of the men in charge of trains, and the insufficiency of the forces assigned to inspection and repair," the result being that "some companies, more particularly in the east, are still controlling trains on steep descending grades by the use of the hand brakes." . . .

Grade Crossings.—Enormous sums of money are now being spent in eliminating grade crossings. This is specially the case on the Pennsylvania Railroad, on which line some very large works, such as viaducts, bridges, and deviation lines are in progress for the purpose of raising the tracks above streets and roads, and for improving grades and curves. These works are being paid for out of revenue, and not charged to capital. . . .

Railroad Service.—In the mode of selection of men and in the opportunities for advancement offered to them, the American railroads are ahead of English companies. The following information on this matter was given to me by one of the chief railroad officers in the States:

"All employees are regarded as in the line of promotion, and examinations for promotion are held from time to time to as may be required.

"Applicants who fail on the first examination must within one year make written application for re-examination. Those who fail on the second examination will be dropped from the service.

"Flagmen, brakemen and firemen who do not apply for examination within five years may be dropped from the service.

"The object of fixing a limit of five years to the term of service of a flagman, brakeman, or fireman, is that these occupations are considered as preparatory training for the positions of conductor and engineman which are the fixed types of employment in the transportation service; and a person who has not the capacity to qualify for either of these positions after five years' service is not likely to do so at any time, and should make way for those who are more capable and progressive."

In this way it happens that every man employed upon an American railroad has the road open to him to rise to the highest position, and many of the most prominent men in the railroad world have so risen.

City Railroads.—. . . As a rule street railroads are electrically equipped on the overhead trolley system, but in New York and Washington the conduit system with center slot is used. In all cases the rails are laid upon cross ties, concrete being as a rule placed between the ties. The use of wood for supporting the rails makes a much quieter track than the English method of laying the rails direct on concrete, but the American method does not enable such a good surface to be maintained on the roadway. English tramways often have a hard and noisy track, and it might be an advantage if a wooden stringer or cushion were placed between the rail and concrete.

Elevated Railroads.—Of the elevated railroads of New York, Brooklyn, Boston and Chicago it is not necessary to say much, as they are not likely to be imitated in any English town. They are noisy and unsightly, and the columns supporting them occupy a great deal of street space and constitute a hindrance to street traffic.

Subways.—The most recent attempt to solve the problem of urban locomotion is to be found in the subways of New York and Boston, each of which is the outcome of a Special Rapid Transit Commission appointed, in the one case by the State of New York, and in the other by the State of Massachusetts—the former in 1894 and the latter in 1891. It was decided that the New York subway should be worked as a railroad, two tracks being reserved for express traffic, and two for local traffic. At Boston it was first intended to devote all the tracks to the use of the tram cars. This was subsequently changed, and where four tracks exist two are now given up to the trains from the elevated railroad and two to the surface street cars propelled by means of overhead trolley. This change of plan was unfortunate, as the grades and curves in the subway, which are suitable for single cars, are found to be detrimental to the trains, causing not only delay, but also undue wear and tear of the wheels, rails, and rolling stock.

The three cities, Paris, New York and Boston, afford an object lesson to London. They have faced the problem of urban communication in a business-like fashion, have decided what they want, have arranged for the financing of the work, and have settled the routes along which transportation is to be provided, before allowing the ground to be broken, instead of proceeding in a haphazard fashion, and leaving the most valuable concessions to be scrambled for by private companies. It is much to be hoped, if I may be permitted to say so, that a tribunal will be appointed before it is too late, to consider the congestion of the London streets and to propose a remedy.

In both Boston and New York the subways are as near the surface of the streets as possible, and have, as in Paris, convenient stairways to afford access to the stations, no elevators being therefore needed. Such subways are in many ways preferable to deep level "tubes." They are safer, more easy of access, possess a purer atmosphere, and afford conveniences to the public which are worth considerable sacrifices to attain. What New York has cheerfully suffered and is still suffering to obtain its subway has to be seen to be believed.

New York has one advantage over London, in that the city is built almost entirely upon rock, and no disturbance is therefore to be feared of the foundations of existing buildings. On the other hand, this rock, which is intensely hard, renders the work of excavating the tunnel a most costly and tedious undertaking.

Inter-Urban Railroads.—Of all the developments of facilities for transportation, the inter-urban lines, which are now such a prominent feature in the United States, are the most interesting and instructive. Such lines are becoming of increasing importance, population becomes more numerous in their vicinity, land values are enhanced, industrial enterprise is stimulated, and the convenience of the public is served by a frequent and cheap means of transportation, not only for passengers, but also for freight. Farmers are said to appreciate the facilities thus afforded them for conveying their produce into the cities, and large quantities of milk are now daily carried into the markets by electric cars. . . . While the electric lines will probably carry the local traffic, passenger and freight, for short distances, they will act as feeders for the through business of the steam roads. In other words, there is a place for each, and their interests are best served by working in harmony.

The experience gained in America in regard to electric inter-urban railroads should be of great value to those engaged in the construction of similar lines, under the name

of "light railroads" in this country. Experience has proved that a substantial, well laid track is a "vital factor" in the economical operation of such a road, and a "large factor" in its earning capacity. The question of the best type of car for such railroads has not yet been finally decided, but a heavy substantial vehicle is necessary, and the wheels should have deep flanges, broad treads, and strong axles. In some instances, as for instance on the Schenectady-Albany line, the depth of the flange is limited by the grooved rail over which the cars have to run within city limits, but where high speeds are aimed at safety requires that the wheels and wheel flanges should be similar to those employed on fast steam roads.

The report is followed by a detailed diary.

Foreign Railroad Notes.

The Great Northern (England) has put into service a new and enlarged "Atlantic" type engine. The leading dimensions are as follows: Boiler, length, 16 ft. 2 in.; mean diameter, 66 in.; heating surface, 2,500 sq. ft., and grate area, 30.9 sq. ft. The driving wheels are 78 in. in diameter, and the steam pressure is 200 lbs. per sq. in.

The new Atlantic compounds of the Baden railroad are now running and have a total heating surface of 2,300 sq. ft. counted on the inner surface of the ribbed tubes or 2,520 sq. ft. if the outside dimensions are taken. There are 279 tubes 1¾ in. in diameter, and the grate area is 42 sq. ft., and the fire-box is wide. The tender carries 4,400 gallons of water and six tons of coal. The new Friedmann lubricator is used and the low pressure cylinders are outside the frames. These engines were guaranteed to haul 200 long tons up a grade of 21 ft. to the mile at 62 m.p.h. This they have greatly exceeded.

TECHNICAL.

Manufacturing and Business.

The Detroit Equipment Co., with a capital of $10,000, has been incorporated.

The Fort Wayne Arch & Culvert Co., Fort Wayne, Ind., has been incorporated with $20,000 capital.

The name of the Federal Supply Co., of Chicago, has been changed to the Independent Railroad Supply Co.

The Harris Manufacturing Company has been organized at Greenville, S. C., to make railroad train signals.

The Twin City Bridge & Iron Works has been incorporated at Port Huron, Mich., with a capital of $10,000.

The Niles Car & Mfg. Co., Niles, Ohio, is adding to its plant a large blacksmith and machine shop, fully equipped with the best machinery.

It is stated in the press that the Chicago, Rock Island & Pacific has given a contract to the Geo. B. Swift Co. to build its new locomotive shops at Moline, Ill., to cost $800,000.

It is said that the Chicago & North Western is going to build a large plant for the treatment of ties and bridge timber by the zinc-tannin preservative process, at Escanaba, Mich.

Eugene Bivert has opened an office at 1763 Monadnock Block, Chicago, as Consulting Mechanical and Electrical Engineer. He will make expert inspection, design and build power plants, steel works and machinery.

The American Car Lubricator Co. has been incorporated in New Jersey, with a capital stock of $1,000,000, by Stephen G. Williams, Valentine Taylor and Kenneth K. McLaren, to make automatic car lubricators.

E. E. Silk, formerly Western Manager for the O. M. Edwards Company, Syracuse, N. Y., has been appointed Secretary and General Manager of the Holland Company of New York, Chicago and San Francisco, with headquarters in Chicago.

James E. Simons, formerly connected with the Pittsburg Coal Company, and more recently with the Hunt Foundry & Machine Company, of Pittsburg, has resigned to become General Manager with the O. M. Edwards Company, of Syracuse, N. Y.

The Chicago Pneumatic Tool Co. has appointed Henry Engels as General Western Sales Agent for the Pacific Coast, with headquarters at 91 Fremont street, San Francisco, Cal.; the business from this section having increased to proportions that require the personal attention of a representative.

Charles S. Powell, who for the past six years has been Manager at Cleveland of the Westinghouse Electric & Manufacturing Company, has been appointed Assistant Manager of the British Westinghouse Electric & Manufacturing Company, with headquarters in the Westinghouse Building, Norfolk street, Strand, London, W. C.

The American Well Works, Aurora, Ill., has issued a pamphlet of sample pages of deep-well pumping appliances, culled from its late catalogue. Chapman's air-lift pumping system is described and illustrated together with a line of belt and steam-driven air compressors. Steam, gasoline and power deep-well pumping engines are shown, also centrifugal pumps, and well-sinking machinery.

Pawling & Harnischfeger, crane and hoist builders, Milwaukee, Wis., expect to move from their present location on Clinton and South Water streets, to a new site just purchased on National and 38th avenues, covering 19⅓ acres. It has a north and south frontage of 2,800 ft., and adjoins the belt line of the C., M. & St. P. and the C. & N. W. Work will at once commence on the new plant, and it will be strictly modern and perfectly appointed.

Iron and Steel.

The Jefferson Iron & Steel Co., Philadelphia, Pa., has been incorporated with $500,000 capital.

The Frankfort Steel Co., with a capital stock of $200,000, has been incorporated under the laws of New Jersey.

The Pennsylvania Steel Tool & Forge Co., Camden, N. J., has been incorporated with a capital of $150,000.

Frank B. Smith has been elected President and General Manager of the Crucible Steel Co. of America (Pittsburg) succeeding Reuben Miller, resigned.

The Southern Car & Foundry Co. has leased the plant of the Hercules Iron & Supply Co. at Anniston, Ala., to take the place of foundries recently destroyed.

The Hyle Steel Tool Co., Hoboken, N. J., has been incorporated with a capital of $1,000,000, by Chas. E. Warren, Carl V. Schoonmaker and Wm. H. Clarke.

The Maryland Steel Co. is said to have received a contract from the New York, Philadelphia & Norfolk for a 122-ft. steel tug for towing car floats between Cape Charles and Norfolk.

Eugene Edwards, General Manager of the United States Steel Company, is interested in a new corporation to be called the New England Steel Co., to be organized at Boston to make steel castings.

The importations of foreign iron and steel for the month of February, through the ports of New York, Philadelphia and Baltimore, were 140,000 tons, which is considerably less than the importations of the preceding month.

The Dominion Iron & Steel Co. has changed the fiscal years of the steel and coal companies to end with the calendar year, instead of April 30 and Feb. 28, as heretofore; and the next annual reports will show the following: Net earnings, coal department, 10 months, $1,977,328; net earnings, steel department, eight months, $390,887; total net earnings, $2,287,215.

Electric Drive at Allis' Works.

The Allis-Chalmers Company is installing generators and motors at the Edward P. Allis Works, West Milwaukee, Wis., to make use of short line shafts. The company does not contemplate the use of multiple voltage drives for individual tools, as now used at the West Allis plant. The work is being done by the company, under the supervision of C. Edwin Search, Superintendent of Equipment.

Irrigation Works.

The Secretary of the Interior, on the recommendation of the Director of the Geological Survey, has given authority for the acquisition of the necessary property, rights of way, etc., preliminary to the construction of irrigation works in five localities as authorized under the reclamation act which passed last June. Work cannot be begun until the rights are obtained and private claims are adjusted. The five projects are: Sweetwater dam, Wyoming; Milk River project, Montana; Gunnison tunnel, Colorado; Truckee project, Nevada, and Salt River reservoir, Arizona. These projects involve $7,000,000 and provide for the irrigation of about 600,000 acres of arid land; in addition the Gray Bull reservoir project will be taken up at once.

THE SCRAP HEAP.

Notes.

A press report from Burlington says that the station agents, telegraph operators and other station employees of the Chicago, Burlington & Quincy have had their pay increased 10 per cent.

The Supreme Court of Louisiana has affirmed the constitutionality of the law, which went into effect last November, requiring the street railroads in New Orleans to provide separate cars for the white and black races.

On Saturday, March 14, the first rail was laid in the track of the Rapid Transit Subway at Columbus Circle, 59th street, New York City. A silver spike was driven by Mayor Low, who used an eight pound maul covered with gilt, and decorated with red, white and blue silk.

Press despatches of Monday and Tuesday last report a number of serious crevasses in the levees of the Mississippi River south of Memphis. At a point below Vidalia it was reported that the levee was broken away for a length of two miles. The Yazoo & Mississippi Valley Railroad was obliged to employ large forces of men to protect its tracks at various points.

According to the Chicago reporters the passenger and freight officers of the railroads in the west are greatly exercised over the change in their status which has taken place in consequence of the enactment of the Elkins Law facilitating the prosecution and punishment of illegal rate cutting. If we may believe the reporters, the railroad men, notwithstanding the great diminution in secret concessions that has been effected during the past year or two, have continued to grant "favors," such as passes and reduced rates, which, under the closer scrutiny now in vogue, are decided to be unlawful. Some of the roads are said to have issued orders to their soliciting agents specifying in great detail the classes of persons and the kind of allowances which are now put under the ban. Moreover, it is said that the railroads have reminded many of their big customers of the clause in the new law which facilitates the punishment of shippers who secure illegal rates and that the shippers have therefore turned over a new leaf.

Purdue University.

Purdue University has recently been the recipient of liberal treatment at the hands of the Indiana State Legislature, just adjourned. By an amendment to a previously existing law, the income of the University has been increased from a 20th of a mill to a 10th of a mill upon the assessed value of the State. The increase is about $65,000, which brings the University's annual income from all sources considerably above $200,000. The Legislature also made specific appropriations amounting in round numbers to $150,000, out of which is to be provided a central heating plant and a building for the department of Physics.

Railroad Building as a Cure for Dyspepsia.

The Hanover (N. H.) *Gazette* prints an account of the examination, in 1883, by the chairman of the U. S. Senate committee on labor, of Sylvester Marsh, builder of the Mt. Washington railroad. Mr. Marsh was asked to give an account of his enterprise. Said he:

"I got my charter from the State, in 1858, for a railroad up Mt. Washington and Mt. Lafayette. Nobody believed in it, and it created quite a burst of laughter when the man in the Legislature read the bill for a charter. Another man got up and moved to add to it 'a railroad to the moon.'" . . .

Q.—"How came you to build that railroad? What put that idea into your mind?"

A.—"Well, I built it for a pastime and to cure the dyspepsia, more than anything else. I retired from business in 1855. After living a few years doing nothing I had the dyspepsia very bad, and was compelled to do something to save my health. I got this idea and worked upon it and built different models of it, until I worked it out. It was ridiculed a good deal and was laughed at, but it cured the dyspepsia."

University of Illinois.

The *Bulletin* of the University says that the Board of Trustees has asked the Legislature for a large appropriation for the College of Engineering in order to increase its equipment and provide properly for the rapid increase in attendance. Although established in 1867, this College has had its chief growth in the last nine years. Four years ago the freshman class numbered 90 students; the present enrollment is 230. The total number of students in the college at the present time is 610, an increase of 27 per cent. over last year's attendance. All but 9 per cent. of these students come from places within the State.

The Siberian Railroad.

The Government Committee, at a recent session at St. Petersburg, published the following figures with regard to the cost to date of the Trans-Siberian Railroad: The length of the road is 5,626 versts (about 3,700 miles), which has cost $192,300,000, exclusive of an appropriation of $47,160,000 to reinforce its means of transport; $5,160,000 for river and harbor improvements; $15,320,600 for colonization purposes, and about $2,500,000 for gold mine surveys, medical relief, etc.

Work To Be Done For the U. S. Navy.

The Act making appropriations for the naval service for the fiscal year ending June 30, 1904, as finally passed by Congress, carries a total of $81,877,291. In all, eight new ships are authorized, three of which (two of steel and one of wood) are to be sailing ships for training enlisted men. The other five ships are to be first-class battleships, three to have a trial displacement of 16,000 tons and two of 13,000 tons, and all to have the heaviest armor and most powerful ordnance for vessels of their class, the highest practicable speed and great radius of action. The 16,000-ton ships are to cost not more than $4,212,000 each and the 13,000-ton ships not more than $3,500,000 each, these prices being exclusive of armor and armament. The Secretary of the Navy may build any or all of the vessels at Navy Yards, and must do so in case of any combination among outside builders; and not more than two of the five battleships shall be built by one contractor. The Secretary of the Navy is also authorized to buy or contract for submarine torpedo boats at an expenditure of not more than $500,000, and tests are authorized between the boats of any American inventors or with Government boats. For hulls, machinery, armor and armament and equipment of vessels previously authorized $25,425,632 is appropriated.

Some of the other appropriations under the different bureaus are:

Ordnance Bureau.—For ordnance material, armament of ships, fuel, material and labor, for maintaining the proving ground, and for target practice $1,500,000. For smokeless powder, $500,000, and for enlarging the factory to make it at Indian Head, Md., $55,000. For a new boiler plant for the power house at the Navy Yard, Washington, D. C., $80,000; for new and improved machinery at existing shops, $50,000; extension of steel castings plant, $5,000, and for converting large gun lathes from steam to electric drive, $25,000, all at Washington Navy Yard. For a new compressed air charging station, machine tools and other improvements at the Naval Magazine, at Iona Island, N. Y., $14,200; for electric elevators and various improvements at Lake Denmark, N. J., $196,000, and for cast steel gun platforms and lightning protection at Indian Head, Md., $10,500.

Bureau of Equipment.—For cables, chains, rope, anchors, tools, signal apparatus, instruments, electrical appliances and all other equipment material for that Bureau, $2,750,000 in all; and for the purchase, transportation and handling of coal, $2,500,000 is allowed.

Bureau of Yards and Docks.—*Navy Yard, Portsmouth, N. H.*, for completing the removal of Henderson's Point, $549,000; additions to railroad and rolling stock, $8,000, the total for all public works at this yard being $917,000. *Navy Yard, Boston, Mass.*—For sewers, electric light plant, and various improvements, $290,500 in all. *Navy Yard, New York.*—For the railroad system, electric plant extensions and all other improvements and extensions, $298,500. *Navy Yard, League Island, Pa.*—For railroad extensions, electric plant, dredging, water pipes, underground conduits and other extensions, in all $309,200. *Navy Yard, Washington, D. C.*—For buildings, coal storage house for new power plant, and other improvements, in all, $224,240. *Navy Yard, Charleston, N. C.*—For new ships, power house, coal storage plant, etc., in all $300,000. *Navy Yard, Norfolk, Va.*, in all $193,000. *Naval Station, Key West, Fla.*, in all $165,000. *Navy Yard, Mare Island, Cal.*—For railroad extensions, locomotive crane, electric plant extensions, etc., in all $188,000. *Navy Yard, Puget Sound.*—For completion of shops, locomotive crane and track, extension of various plants and other improvements, in all $295,000. *Naval Station, Cavite, P. I.*—For distilling plant and floating steel dry dock, in all $320,000. *Naval Station, New Orleans, La.*,

in all $111,800. *Navy Yard, Pensacola, Fla.*, in all $143,000. The grand total for public works, Bureau of Yards and Docks, is $4,336,940.

Bureau of Navigation.—A total of $296,750 is allowed, and the limit of cost for the new buildings and other improvements at the Naval Academy at Annapolis is increased to $10,000,000.

Bureau of Construction and Repair.—For the preservation, and completion of vessels, for materials of all kinds, machine tools, instruments, all purposes, in all $8,000,000.

Bureau of Steam Engineering.—For completion, repair and preservation of machinery and boilers of naval vessels, new boilers, distilling, refrigerating and auxiliary machinery, etc., $2,190,000, and in all for steam machinery, $3,405,000. For electric cranes and large machine tools for equipment of shops, Navy Yard, Boston, Mass., $60,000. For a building at Annapolis, Md., for an experiment station and testing laboratory, $250,000, and for the complete equipment of the building with all necessary apparatus, $150,000.

LOCOMOTIVE BUILDING.

The Wheeling & Lake Erie is having three locomotives built at the Rogers Works.

The Peruvian Corporation Co., Ltd., is having four locomotives built at the Rogers Works.

The Canadian Pacific is having 10 locomotives built at the Schenectady Works of the American Locomotive Co.

The Boston & Maine is having 10 locomotives built at the Manchester Works of the American Locomotive Co., in addition to the 20 reported in our issue of Jan. 16.

The Erie is reported as ready to let contracts in the near future for a large number of locomotives. This number is stated to be about 150.

The Illinois Central, as reported in our issue of March 13, has ordered 35 simple consolidation, 10 six-wheel simple switching and five simple Atlantic-type locomotives from the Rogers Locomotive Works. The consolidation and Atlantic-type locomotives are similar to those recently ordered from the Rogers Locomotive Works, and reported in our issue of Feb. 13, last, with the exception that the Atlantic-type locomotives have 3,191 sq. ft. of heating surface and 350 Illinois Central special National Tube Co.'s tubes. The switching locomotives are similar to those ordered from the Rogers Locomotive Works last summer, and reported in our issue of Sept. 12, 1902. The special equipment for all will include: Taylor iron axles, Golmar bell ringers for consolidation and Atlantic-type locomotives, Pressed steel brake-beams, Lappin brake-shoes, Monitor and Ohio injectors, Cicero bronze journal bearings, Jerome piston and valve rod packings, Ashton safety valves, Leach sanding devices, Nathan sight-feed lubricators, American Railway Steel Spring Co.'s springs, Ashton steam gages, and Midvale and Latrobe truck and tender wheel tires for consolidation and Atlantic type locomotives.

CAR BUILDING.

The Southern Pacific is having 100 coaches built by the Pullman Company.

The American Car & Foundry Co. has miscellaneous orders for 96 cars.

The Louisiana & Arkansas is having 100 freights built at Barney & Smith's.

The Pennsylvania is having 100 freights built by the Cambria Steel Co., Johnstown, Pa.

The Maryland & Pennsylvania is having 10 freights built at the South Baltimore Car Works.

The New York, Ontario & Western is having eight coaches built by Harlan & Hollingsworth.

The Toledo, St. Louis & Western has ordered 50 box cars from the American Car & Foundry Co.

The Erie is reported to be about to ask bids for new equipment amounting to several thousand cars.

The New York Central & Hudson River has let a contract for 53 passenger coaches to Barney & Smith.

The Delaware, Lackawanna & Western has ordered 25 80,000-lb. freight cars from the American Car & Foundry Co.

The Chicago & Western Indiana is having 50 freights built at the West Detroit Works of the American Car & Foundry Co.

The Chicago, Milwaukee & St. Paul, as reported in our issue of March 13, expects to build 1,000 box and 300 stock cars at its shops, of the same general style as this class of cars which the road has been building heretofore.

The Chicago, Burlington & Quincy was incorrectly stated in this column as having given an order to the American Car & Foundry Co. No order has yet been given, but the company is asking bids on 2,000 side dump coal cars.

The Buffalo, Rochester & Pittsburgh has ordered 500 80,000-lb. hoppers; 100 40,000-lb. low gondolas; 165 60,000-lb. drop bottom gondolas; 35 60,000-lb. refrigerator, and 100 60,000-lb. box cars from the American Car & Foundry Co.

The Mexican Central is having four baggage cars built at Barney & Smith's, August, 1903, delivery. The special equipment includes National hollow brake-beams, Westinghouse brakes, National Miller Comb couplers, Westinghouse friction draft rigging, Soule dust guards, Pintsch gas, Valentine paint and Pittsburg springs.

The Illinois Central has ordered 14 chair cars and 10 coaches from the Barney & Smith Car Co. The chair cars will weigh 93,200 lbs., and measure 61 ft. long and 10 ft. wide. The coaches will weigh 92,000 lbs., and measure 61 ft. long and 10 ft. wide. The special equipment for both will include: M. C. B. axles, Lappin brake-shoes, Hewitt Manufacturing Co.'s brasses, Forsyth curtain fixtures, Pantasote curtain material, Ryan dust guards, Safety Car Heating & Lighting Co.'s heating system, McCord journal boxes and lids, Pintsch gas light, Sherwin-Williams paint, Standard steel platforms, Railway Steel Spring Co.'s springs, Pullman wide vestibules and Paige wheels.

The Canadian Northern has ordered six second-class coaches and three baggage and mail cars from the Crossen Car Manufacturing Co. (Cobourg, Ont.), for May and June delivery. The same road has ordered four first-class coaches, three sleeping cars and two tourist sleeping cars from the Barney & Smith Car Co., for June and July delivery. The day coaches will be 57 ft. long, 9 ft. 10½ in. wide, over sills, and 6 ft. 8½ in. high, from top of sill to bottom of plate. The sleeping cars will be 70 ft. long, over sills, 9 ft. 10½ in. wide, over sills, and 6 ft. 8½ in. high, from top of sill to bottom of plate. The tourist cars will be 60 ft. long, 10 ft. ½ in. wide, over sills, and 6 ft. 8½ in. high, from top of sill to bottom of plate. The special equipment for all will include: Westinghouse air-brakes; National couplers, with M. C. B. heads; Pantasote curtain fixtures; Consolidated Car Heating Co.'s steam heating system; Avery acetylene gas lights, Standard steel platforms; Barney & Smith seats for first-class coaches; Barney & Smith standard trucks; and Pullman wide pattern vestibules.

The Niles Car & Manufacturing Co., Niles, Ohio, has shipped during the past 30 days: Ten vestibule 28-ft. car bodies to the Toledo Electric Ry. & Light Co.; 25 20-ft. car bodies to the Havana Electric Ry. Co., Cuba; two double-truck baggage and work cars, Western Ohio Ry. Co., Lima, Ohio; ten 62-ft. passenger coaches, full vestibule, six-wheel trucks, to the Seaboard Air Line. These are for the Florida train, and will run between Jersey City and Florida. Shipment will be made shortly of: Ten 28-ft. vestibule cars to the Des Moines City Ry. Co., Des Moines, Iowa; six 28-ft. vestibule car bodies to the Pennsylvania & Mahoning Valley Ry. Co., Youngstown, Ohio; four 28-ft. vestibule car bodies to the United Power Co., East Liverpool, Ohio; 25 electric car bodies to the Havana Electric Ry. Co., Cuba. The company is building eleven 70-ft. passenger coaches and five combination cars for the Terre Haute & Indianapolis (Vandalia). These cars will be over all in length about 78-ft., and are the first of this type to be built by a Pennsylvania system road. They will be mounted on six-wheel standard trucks and built under the general specifications of the Pennsylvania. They are intended for the through trains between Jersey City and St. Louis. Also there are being built 10 additional coaches and two baggage cars for the Western Ohio Ry.

BRIDGE BUILDING.

ALLENTOWN, PA.—The Common Council has passed an ordinance allowing the city to borrow $35,000 for a new bridge on Allen street, to connect the Tenth and Sixth wards.

ATLANTIC CITY, N. J.—Bids for April 1 are being advertised for building two steel draw bridges on the road to Pleasantville.

BELOIT, WIS.—An ice gorge on Turtle Creek destroyed two bridges.

BERRIEN SPRINGS, MICH.—It is announced that Berrien and Oronoko townships will build a steel bridge over St. Joseph River at Ferry street, to cost about $20,000.

BETHLEHEM, PA.—The Lehigh Valley Traction Co. has let a $14,000 contract to the National Bridge Co. of Oswego, N. Y., to strengthen the Broad street bridge between this place and West Bethlehem.

BUCYRUS, OHIO.—The County Commissioners have granted the Ohio Central Traction Co. permission to build a bridge over the Big Four tracks.

BURLINGTON, IOWA.—The City Engineer is reported to be making plans for the new Sixth street viaduct.

CHARLOTTE, N. Y.—The Rome, Watertown & Ogdensburg, it is reported, will build a new steel bridge at this place.

COLUMBUS, OHIO.—L. E. Jones, County Auditor, will receive bids up to April 14 for furnishing material and building several small bridges in the county.

CONNEAUTVILLE, PA.—The County Commissioners favor a steel bridge 65 x 16 ft. over Conneaut Creek; a steel bridge 70 x 16 ft. over Caldwell Run in Oil Creek Township, and a bridge 35 x 16 ft. in Summit Township.

DAKOTAH, IOWA.—The Board of Supervisors of Humboldt County will receive bids until 2 p. m. April 7 for building bridges for the year 1903. John Cunningham, County Auditor.

DANNEBROG, NEB.—The wagon bridge at this place and a number of smaller bridges in Howard County are reported to have been washed out. Bridges were also destroyed at Louisville, Neb., and at Schuyler.

DELANCO, N. J.—It is reported that plans are being made by the Pennsylvania for a steel draw bridge over Rancocas Creek.

DERBY, CONN.—The Naugatuck iron bridge has been condemned.

ENNISMORE, ONT.—The Victoria County Council will build a steel bridge to replace the ferry at Gannon's Narrows between this place and Harvey. Address the County Clerk, Peterborough, Ont.

FULLERTON, NEB.—Bridges over the Loup River at this place and at Palmer have been destroyed by high water.

GENEVA, ALA.—A bill has been passed authorizing the Commissioners of Geneva County to build a bridge across the Choctowhatchee River.

GRAND RAPIDS, MICH.—Isaac F. Lamoreaux, City Clerk, will receive bids until 4 p. m., March 21, for $50,000 of bonds for the bridges across Grand River at Wealthy avenue and at Bridge street.

The old North Park bridge has been destroyed by high water. This bridge was condemned two years ago and a bill is now in the Legislature authorizing Kent County to bond itself for $20,000 to build a new bridge in its place.

HARRISBURG, PA.—A bill has been introduced in the State Legislature providing for the incorporation of the Northampton Bridge Co., to build a bridge over the Delaware River at Martha Creek. This company has already been incorporated in New Jersey.

HOLBROOK, ARIZ.—According to report, bids will be received by A. F. McAllister, Clerk, until April 6, for a bridge near Woodruff.

HUTCHINSON, KAN.—The Commissioners of Reno County have made an appropriation toward a $3,000 bridge to be built across Arkansas River between here and Haven.

JERSEY SHORE, PA.—The trolley company will build an iron bridge over Pine Creek at this place.

KANSAS CITY, KAN.—A press despatch says that the Legislature has authorized a company to build a $30,000 bridge across Kaw River.

KINGSTON, MO.—Dave Stucke, Road and Bridge Commissioner, will receive bids until 2 p. m., March 27, for 17 bridges to be built in Caldwell County.

LOS ANGELES, CAL.—A despatch says that an extension of the Midland Pacific will require 35 bridges.

MEMPHIS, TENN.—According to report, a $50,000 steel and concrete bridge is to be built across Broadway at Porter street by the city and the railroads interested.

MINNESOTA CITY, MINN.—The County Commissioners have decided to build an iron bridge over the Rolling Stone.

MONTGOMERY, N. Y.—The town of Montgomery will issue $9,000 bonds for bridge and highway improvement.

NEW HAVEN, CONN.—The question is being agitated again of having a draw in the bridge over the West River instead of a stationary bridge. C. W. Kelley, City Engineer, writes that the matter has not yet been determined.

NEW YORK, N. Y.—Louis F. Haffen, President, Borough of Bronx, will receive bids until March 23 for a bridge and abutments across the New York & Harlem R. R. at East 189th street.

The contract for building 14 bridges in the Bronx has been awarded to the American Bridge Co., for $310,700.

PLEASANTON, KAN.—Bills have been passed for building four new bridges in Lynn County.

PORTLAND, ORE.—It is expected that the Grand avenue bridge from East Stark to East Oak street will soon be replaced by a new structure.

ROARING RIVER, N. C.—Local press reports say that a county bridge will be built over the Yadkin River.

ROBY, TEXAS.—The time for receiving bids for building two steel bridges has been extended to March 28.

ST. JOHN, N. B.—The City Council is considering building a bridge across the harbor at Navy Island.

ST. PAUL, MINN.—It is reported that the Council has granted permission to the Stillwater Trolley Co. to build a steel bridge over the Omaha tracks.

SAN BERNARDINO, CAL.—According to report, plans have been made for two steel bridges over the Colton-Redlands road, to cost $10,000.

STITES, IDAHO.—The town and county will build a $2,000 bridge across the Clearwater River at this place.

TACOMA, WASH.—It is reported that plans have been approved for the Puyallup bridge, and that bids will soon be advertised.

TAYLOR, MD.—The Commissioners of Harford and Baltimore Counties are planning to build a bridge over the Little Gunpowder River.

TOLEDO, OHIO.—The Wheeling & Lake Erie is said to be preparing plans for a new double track bridge across Maumee River.

UTICA, N. Y.—It is announced that a bridge will be built across the Genesee River just west of Park avenue.

WILLIAMSPORT, PA.—The Grand Jury has recommended an iron bridge, 100 ft. long, between the Maynard and Basin bridges, and condemned the Basin bridge.

Other Structures.

ASHEVILLE, N. C.—It is said that the Southern Ry. is planning to build a new union station at this place.

CAMDEN, N. J.—It is reported that the Whitney Car Wheel Works will build a $10,000 plant at this place.

CHATHAM, N. Y.—The Boston & Albany station was destroyed by fire last week.

CHICAGO HEIGHTS, ILL.—The Railway Supply & Foundry Co., whose plant at Harvey, Ill., was recently destroyed by fire, is reported to have let a contract for a new plant to be built at this place.

CINCINNATI, OHIO.—According to press reports, the Baltimore & Ohio Southwestern will build a new freight house 580 ft. x 60 ft., in this city.

DALLAS, TEXAS.—It is reported that the Dallas Street Ry. is about to build a $75,000 car barn.

DETROIT, MICH.—The Detroit Foundry Co., it is said, will build a new steel frame building 100 x 200 ft.

FORT WORTH, TEXAS.—The Texas & Pacific shops are to be remodeled and enlarged.

JACKSON, TENN.—The Southern Engine & Boiler Works will build a new foundry.

MANKATO, MINN.—It is understood that the Chicago Great Western and the Milwaukee roads will build a $60,000 joint passenger station at this place.

MILWAUKEE, WIS.—The Worden-Allen Structural Iron Works is getting ready to build a $30,000 plant.

MINOT, N. DAK.—Local press reports announce that a $30,000 union station will be built at this place.

MOULTRIE, GA.—It is reported that the Georgia Northern will remove its shops from Pidcock to this place.

MT. SAVAGE, MD.—The Union Mining Co. will rebuild its foundry.

RUSK, TEXAS.—The State Legislature has appropriated $150,000 to buy timber lands and build a 50-ton iron furnace at the penitentiary.

SYRACUSE, N. Y.—Fraser & Jones are reported to be planning a $10,000 addition to their foundry.

TOLEDO, OHIO.—A boiler explosion recently wrecked a large part of the East Toledo mills of the Republic Iron & Steel Co., causing a damage of about $40,000.

WAXAHACHIE, TEXAS.—It is said that a new station will soon be built at this place by the Missouri, Kansas & Texas.

YOUNGSTOWN, OHIO.—Press reports say that the Baltimore & Ohio will build a new passenger station at this place.

ZION, ILL.—The North Western is preparing, it is said, to build a large station here.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad associations and engineering societies see advertising page xvi.)

Richmond Railroad Club.

The regular monthly meeting of the Richmond Railroad Club was held March 12. The report of the Committee

on Revision of the Rules of Interchange was presented and a paper on Per Diem was read by Mr. Geo. S. Sipp, Car Service Agent of the Chesapeake & Ohio. This paper is given in another column.

New York Railroad Club.

The next meeting of the club will be held at 8 p.m., March 20, in Carnegie Hall, 154 West 57th street, New York City. A paper will be presented on "Heating and Ventilating of Railroad Shops," by J. I. Lyle, M.E. "The Revision of the Rules of Interchange" of the Master Car Builders' Association will also be considered.

The Engineers' Club of Philadelphia.

A regular meeting of the club will be held March 21 at 8 p.m., and Howard W. DuBois will read a paper on "Reconnaissance Methods of Surveying in a Mountainous District." In addition to a large number of views of the Rockies of British Columbia this communication will be illustrated by new instruments for this class of surveying. H. B. Schermerhorn read a paper on "The State of the Art" in patent cases.

Western Society of Engineers and American Institute of Electrical Engineers (Chicago Branch).

A joint meeting of these two societies will be held Tuesday evening, March 24, in Fullerton Hall, Art Institute, Chicago. The Chicago Transportation Problem will be the subject for the evening, and Mr. Bion J. Arnold will present a resumé of his recent report on this matter to the Chicago City Council. The presentation will be illustrated with lantern slides.

The Franklin Institute.

The bulletin for March and April includes: March 18, "The Brazing of Iron Castings," Mr. A. D. Bramhall, Philadelphia; March 19, "What Physical Chemistry Has Done for Chemistry," Dr. Harry C. Jones, Johns Hopkins University, Baltimore, Md.; March 26, "Modern Methods of Electrical Standardizing," Dr. Frank A. Wolff, National Bureau of Standards, Washington, D. C.; April 2, "A Study of Alloys Suitable for Bearing Metals," Mr. G. H. Clamer.

Canadian Railway Club.

The first annual meeting of the Canadian Railway Club was held at Montreal, Can., on Jan. 6. The Club started last year with 36 members and now has a membership of 240, 36 of whom are non-residents. The present officers of the Club were unanimously re-elected. A paper on Air-Brakes, by A. B. Brown, of the Westinghouse Air-Brake Company, which was recently read before the New England Club, is printed in the published annual report, and will be taken up for discussion at a later meeting.

American Street Railway Association.

The 22nd annual meeting will be held at the Grand Union Hotel, Saratoga Springs, N. Y., on Wednesday, Thursday and Friday, Sept. 2, 3 and 4. The programme so far arranged includes papers on the following subjects: Electric Welded Joints, The Evils of Maintenance and Champerty in Personal Injury Cases, Train Orders and Train Signals on Interurban Roads, Freight and Express on Electric Railroads, The Manufacture and Distribution of Alternating Currents for City Systems, Comparative Merits of Single and Double Truck Cars for City Service, The Right of Way. There will be a large exhibition of railroad supplies at the Grand Union Hotel, which will be the headquarters of the convention. T. C. Penington, Secretary, Chicago.

PERSONAL.

—Mr. J. L. Freeman, General Baggage Agent of the Lake Shore & Michigan Southern, died recently. Mr. Freeman was about 70 years old and had been in the service of this company for many years.

—Mr. Eli S. Quintard, formerly Superintendent of the New Haven & Derby, now a part of the New York, New Haven & Hartford, died at New Haven, Conn., March 16, aged 83 years. He was a native of Norwalk. His early railroad service was on the New Haven road, and then for several years he was Superintendent of the Cincinnati, Sandusky & Cleveland.

—Mr. W. R. Martin, who recently assumed the duties of General Manager of the El Paso-Northeastern, has been in railroad service since early boyhood. He is a Canadian by birth and is 49 years old. Mr. Martin began his railroad service with the Grand Trunk as telegraph operator and has been connected with the New York Central & Hudson River, the International Bridge Company, the Chicago, Milwaukee & St. Paul, and the Southern Pacific in various capacities. He has been with the latter company at Lordsburg and El Paso since 1888.

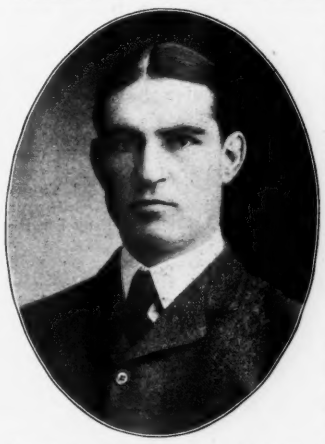
—Mr. Arthur Montzheimer, the new Chief Engineer of the Elgin, Joliet & Eastern, and the Chicago, Lake Shore & Eastern, was born in 1869. His railroad career dates from 1886, when he began with the Chicago & North Western at Eagle Grove, Iowa, as a clerk, and with the exception of one year at college he has been associated with this road in various capacities for the past 17 years. In 1889-91 he was in charge of second track construction, and in 1895 was appointed Superintendent of Bridges and Buildings of the Milwaukee Division at Milwaukee. Several years later he took a similar position on the Wisconsin Division. He has been a member of the Association of Railway Superintendents of Bridges and Buildings for a number of years, and was, until recently, a member of the executive committee. Last fall Mr. Montzheimer was elected Fourth Vice-President of this Association.

—Mr. Arthur W. Trenholm, the new General Manager of the Chicago, St. Paul, Minneapolis & Omaha, entered the service of the company a very young man 23 years ago as a clerk in the auditor's department, and his progress was gradual. He became in turn Traveling Auditor, Local Freight Agent at St. Paul, Superintendent of Terminals at St. Paul, Superintendent of the Northern Division, at West Superior; Superintendent of the Sioux City Division, at Omaha; Assistant General Superintendent and General Superintendent. This last named position he has held for the past three years.

—The new Master Mechanic of the Denver & Rio Grande at Denver, Mr. David Patterson, was born at Paterson, N. J., in 1854, and entered the service of the Union Pacific in 1870 as machinist apprentice immediately after graduating from the public school (Chicago). He was successively machinist, tool maker, general foreman and master mechanic at different points on same road. Mr. Patterson had charge of the Utah Division at Salt Lake City for six years. From 1898 up to November, 1901, he was Master Mechanic of the Kansas City Southern; then Division Master Mechanic of the Atchison, Topeka & Santa Fe up to the time of his appointment on the Denver & Rio Grande as above.

—Mr. M. W. Thomson, Engineer Right of Way of the Pennsylvania Railroad at Altoona, died at his home in that city on Wednesday, March 11. He was stricken with apoplexy while giving some testimony in the Court at Pittsburg on Tuesday, March 10, from which attack he never rallied. Mr. Thomson was 59 years old and began his career with the Pennsylvania Railroad on March 22, 1880, on construction work of South West Pennsylvania Railway, filling various positions until Aug. 1, 1883, when he was appointed Principal Assistant Engineer, with office at Altoona. On Aug. 1, 1900, he was made Engineer Right of Way at the same point. Mr. Thomson was a graduate of Princeton, and before entering the service of the Pennsylvania Railroad spent considerable time in the steel business. In this line he was regarded as an expert. He was well-known to the *Railroad Gazette* readers, having from time to time written articles, principally with regard to railroad splice bars, of which he made a study for a number of years. His latest splice, the 100 per cent. joint, is now being tried on a number of railroads throughout the country.

—Mr. Wallace C. Winter, who has just succeeded Mr. Trenholm, the new General Manager, as General Superintendent of the Chicago, St. Paul, Minneapolis & Omaha, is a graduate of Yale University (Sheffield Scientific School). Mr. Winter was born in 1872 and began his railroad career at the age of 21, entering the service of the above company as a clerk in the general freight office. He subsequently became traveling auditor and assistant claim agent. For one year (1898-1899) he was Assistant Superintendent of the Sioux City Division, but was later transferred to the Northern Division, and again in 1900 he was transferred to the Wisconsin Division. As will be seen Mr. Winter's entire service has been with this company. It is said that his choice of railroading as a profession was inadvertent; that he had no intention of following it until an incident occurred after his graduation. He had played "tackle" on the famous Yale football team of '94, with Heffelfinger, the great guard, and McClung, the fleet halfback. These friends were resting in Minneapolis at the time of the Debs strike, while all freight handling between Minneapolis and St. Paul was tied up. On this congested part of the line there were many strategic points of advantage to the strikers around the yards, and especially on the overhead highway bridges, and trains could not be moved. Winter and McClung became interested and applied to the President of the Omaha road for permission to organize and drill teams, on football principles, to disperse the rioters. They were allowed to undertake this after a preliminary, few days, course of study of the blue prints of the yards and verbal instruction from the yardmaster. The work was thoroughly organized and successful; the football experts had the time of their lives, for there was no umpire, and the rioters learned that there's no place like home. Winter became enamored of railroading.



ELECTIONS AND APPOINTMENTS.

Albany & Hudson Railroad.—The Albany & Hudson Railway & Power Company has been taken out of the hands of the receiver and reorganized under this name, and the officers of the new company are: President, C. L. Rossiter; First Vice-President, A. M. Young; Second Vice-President and General Manager, George G. Blakeslee; Secretary, L. B. Grant, and Treasurer, H. G. Runkle. The Superintendent of the railroad is J. S. Gillespie, formerly Assistant Superintendent of the Baltimore & Ohio, and the Electrical Superintendent is R. P. Leavitt, formerly with the Union Traction Company. (See R. R. Construction column.)

Baltimore & Ohio.—It is reported that I. G. Rawn, General Superintendent at Pittsburg, has resigned to take effect April 1.

Blackwell, Enid & Texas.—The following officers have been elected: Treasurer, L. G. Hawkins; Secretary and Auditor, A. Strauss, Jr.; Assistant Secretary and Assistant Treasurer, F. H. Hamilton, and General Freight and Passenger Agent, B. P. Brummett.

Canadian Northern.—E. Langham has been appointed Purchasing Agent, with headquarters at Winnipeg, Man.

Central New England.—Edward I. Sackett, formerly Division Superintendent of the Boston & Albany in Springfield, has been appointed Assistant General Manager of the C. N. E., with headquarters at Hartford.

Chicago & North Western.—W. E. Dunham has been appointed Mechanical Engineer, with headquarters at Chicago, Ill., succeeding E. B. Thompson.

Chicago, St. Paul, Minneapolis & Omaha.—A. W. Trenholm, heretofore General Superintendent, has been appointed to succeed the late Mr. Scott as General Manager. W. C. Winter has been appointed to succeed Mr. Trenholm as General Superintendent, and Mr. Winter in turn will be succeeded by Assistant Division Superintendent William Bennett.

Cleveland, Akron & Columbus.—William Hodgdon, General Freight Agent, with headquarters at Columbus, Ohio, has resigned. (See Vandalia Line.)

Delaware, Lackawanna & Western.—P. J. Flynn has been appointed Freight Traffic Manager, with headquarters in New York. J. H. Crawford has been appointed to succeed Mr. Flynn as General Freight Agent at New York, and N. Duke, heretofore General New England Freight Agent at Boston, has been appointed to succeed Mr. Crawford as General Eastern Freight Agent.

Denver & Rio Grande.—S. W. Meyer has been appointed Auditor of Disbursements; F. M. Dewees, Auditor of Freight Receipts, and J. F. Howe, Auditor of Passenger Receipts. All three offices are new ones.

Gulf & Ship Island.—S. D. Boyleston has been appointed General Freight and Passenger Agent, with headquarters at Gulfport, Miss.

Ilwaco Railway & Navigation Company.—D. B. Smith has been appointed Superintendent, with headquarters at Ilwaco, Wash., succeeding J. R. Goulter, resigned.

Lake Shore & Michigan Southern.—T. J. Dawson has been appointed Assistant Division Superintendent, with headquarters at Elkhart, Ind.

Missouri Pacific.—On March 17, A. C. Bird, recently appointed Traffic Director of the Gould Lines, was elected a Vice-President of the M. P., the St. Louis, Iron Mountain & Southern and the Wabash. The headquarters of General Superintendent E. A. Gould have been removed from St. Louis to Kansas City, Mo.

E. H. Holden, heretofore Chief Despatcher, has been appointed Division Superintendent, with headquarters at Concordia, Kan., succeeding J. F. Simms, and Mr. Holden in turn is succeeded by J. J. Skinner. Mr. Skinner's headquarters will be at Atchison, Kan.

Northern Pacific.—W. C. Albee, Assistant Division Superintendent at Tacoma, Wash., has been appointed Acting Division Superintendent at Missoula, Mont., succeeding C. Russell, who has been granted leave of absence for a few months.

Oklahoma Southwestern.—The officers of this company are: W. L. Mahoney, President and General Manager; James N. Cook, Vice-President; M. A. Lally, Second Vice-President; J. G. Queenan, Secretary and Treasurer; R. E. Echols, General Solicitor, and John Overholt, General Superintendent. General offices at Elk City, Okla. T. (See R. R. Construction column.)

Pennsylvania.—F. M. Ashmead, heretofore Assistant Engineer, has been appointed Engineer Right of Way, with headquarters at Buffalo, N. Y. J. R. McGraw, Supervisor on the Philadelphia, Baltimore & Washington, has been appointed to succeed Mr. Ashmead at Pittsburg, Pa.

H. W. Fitzgerald has been appointed Supervisor, with headquarters at Patton, Pa.

Peoria & Pekin Union.—At a meeting of the Directors held March 10, Curtiss Millard was elected President and General Manager, with headquarters at Peoria, Ill., succeeding J. A. Barnard.

Philadelphia, Baltimore & Washington.—J. R. McGraw, Supervisor at Chester, Pa., has resigned. (See Pennsylvania.)

Savannah & Statesboro.—W. B. Moore has been appointed Auditor, with headquarters at Statesboro, Ga.

St. Louis, Iron Mountain & Southern (Missouri Pacific).—The headquarters of W. T. Tyler, General Superintendent, have been removed to Little Rock, Ark.

Southern.—A. Ramseur has been appointed Superintendent of the Asheville Division, with headquarters at Asheville, N. C., succeeding G. R. Loyall, who has been appointed Superintendent of the Knoxville Division at Knoxville, succeeding C. L. Ewing. H. A. Williams becomes Superintendent of the Norfolk Division at Lawrenceville, Va., succeeding Mr. Ramseur, and W. G. Choate succeeds A. Gordon Jones, transferred, as Superintendent of the Washington Division at Alexandria, Va.

Union Pacific.—J. Turtle has been appointed Master Mechanic, with headquarters at Denver, Colo.

Union Terminal (Sioux City, Iowa).—H. C. Anderson has been appointed Master Mechanic, with headquarters at Sioux City.

Vandalia Line.—William Hodgdon, heretofore General Freight Agent of the Cleveland, Akron & Columbus, has been appointed General Freight Agent of the Vandalia, with headquarters at St. Louis, Mo.

Wabash.—See Missouri Pacific.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ARKANSAS COAL & MINERAL.—This company has filed an amendment to its charter, providing for the building of a line from Hartford north to Harrison, 125 miles, connecting with the mineral fields in northern Arkansas. J. W. Goldsby, Waldron, Ark., and E. T. McConnell, J. F. Williams and others, of Huntington, Ark., are interested.

ARKANSAS, MISSOURI & KANSAS.—Bonds have been sold for the building of this new line from Chanute, Kan., southeast via Joplin, Mo., to Memphis, Tenn. The total distance will be about 400 miles, and the estimated cost is $12,000,000. The company was incorporated in July, 1901. W. D. Spooner, Joplin, Mo., is Chief Engineer. (Oct. 3, 1902, p. 765.)

BALTIMORE & FREDERICK (ELECTRIC).—Work is reported begun on this new electric line from Baltimore, Md., via North Branch, Winfield, Unionville and Liberty, to Frederick, 45 miles. Newhall & Co., Baltimore, Md., are the contractors. James E. Ingram, Jr., of Baltimore, is President. (See Construction Supplement.)

BALTIMORE & OHIO.—An officer writes that the demand for West Virginia coal and lumber in the West and Northwest has resulted in comprehensive plans for handling a very large business from that territory. With this idea in view, the Cleveland, Lorain & Wheeling, running from Bellaire to Lorain, Ohio, on Lake Erie, with a Cleveland branch, was purchased. Surveys of this line were made and it was decided to reduce the northbound grade from Bellaire to Holloway to a maximum of 25 ft. to the mile, and from Holloway to Lorain, to 18 ft. The present maximum is double that, and the heaviest trainload is 1,220 tons. When the reduction is completed, the trainload can be increased to 2,280 tons. Contracts for most of this improvement have been let and work has commenced. A connection will be built at Bellaire with the B. & O. It is also proposed to build

a low grade connection between the Wheeling Division at Mannington and the Short Line at Smithfield, using the low grade Ohio River Division to Benwood. At Fairmont a new yard is being made, and when it is done trains will run through to Holloway. The total cost of the improvements necessary to economically transport the lake and Western coal and the other products of West Virginia will exceed $3,500,000.

BROOME COUNTY (ELECTRIC).—This company has been incorporated in New York to build from Vestal northeast to Binghamton, 15 miles. Albert B. Waters, Wilkesbarre, Pa.; E. J. Bond, Baltimore, and D. E. Baxter, of New York city, are directors.

BUFFALO & NIAGARA TERMINAL.—This company has been incorporated in New York to build a steam road from Niagara Falls southeast via Tonawanda to Buffalo, 22 miles, with a branch from a point on the Niagara River near Buffalo, east to Depew. The directors are I. M. Dittenhoefer, of New York; Jas. N. Adam, A. J. Wheeler, C. D. Marshall, of Buffalo, and others.

BUTTE COUNTY.—A contract has been let to Stone Bros., of Oakland, Cal., to build this new line in Butte County, Cal., between Chico and Paradise, 14 miles. Work is reported in progress. This company was incorporated in New Jersey in January last. E. D. Newcombe, East Orange, is one of the incorporators. (Jan. 30, p. 91.)

CANADIAN NORTHERN.—Contract has been let to A. McMillan for the grading of an extension from Clan William, Manitoba, 65 miles northwest, via Shoal Lake, to Rossburn. Work will be begun as soon as the ground and the weather will permit.

CANADIAN PACIFIC.—It is reported that contracts have been let for a branch line from Arcola, N. W. T., to Regina, 144 miles, and that work will be begun in the early spring.

CANANEA, YAQUI RIVER & PACIFIC.—Grading is reported in progress on the line from Cochise Station, on the Southern Pacific, south to Naco, 65 miles. R. R. Coleman, of Prescott, Ariz., has the contract.

CENTRAL FLORIDA & INDIAN RIVER.—Application is being made for a charter for this company to build from Melbourne, Fla., northwest to Orlando, and west to Bartow, about 125 miles. E. O. Painter, Jacksonville; W. T. Wells, Melbourne, and others are interested.

CHAUTAUQUA TRACTION (ELECTRIC).—This company was incorporated on March 7 to build from Lakewood, N. Y., northwest to Mayville, 17 miles. Capital, $500,000. Wm. Broadhead, S. B. Broadhead and A. C. Wade, of Jamestown, N. Y., are directors.

CHICAGO, BURLINGTON & QUINCY.—Surveys are reported in progress for an extension from Sioux City, Iowa, south to Ashland, Neb., 100 miles, to a connection with the Great Northern.

CHICAGO, ROCK ISLAND & PACIFIC.—Plans are reported practically completed for an extension of this line from Fort Dodge, Iowa, northeast to Dows, 36 miles, forming a connection with the Burlington, Cedar Rapids & Northern Division. A branch between Mallard and Emmetsburg, Iowa, is reported projected.

CINCINNATI, BLUFFTON & CHICAGO.—This company has been incorporated in Indiana to build from Huntington southeast via Bluffton, Pennville and Portland to Union City, 90 miles. S. H. Bracey, A. R. Nettleton, W. A. Howard and C. D. Waterbury, of Portland, Ind., are said to be interested.

CONCORD & CHELMSFORD.—Incorporation is being asked by this company to build a north and south line between Chelmsford, Concord and Carlisle, in Massachusetts, a distance of about 12 miles. It is proposed to use the new line for freight as well as for passenger service. Frederick Winsor, Concord, Mass., is said to be interested.

DES MOINES & SOUTHERN.—Bids are being asked by this company for the building of a line from Greenfield, Iowa, northeast via Winterset to Norwalk, 46 miles, where a connection will be made with the Keokuk & Western Division of the C., B. & Q. Rights of way have already been secured. F. W. Cherry, Des Moines, Iowa, is interested. (See Construction Supplement.)

FARMVILLE & JAMES RIVER VALLEY.—Surveys are reported on this line from Rosney, Va., southwest to Danville, 80 miles. Work will be begun as soon as surveys have been completed.

GREAT NORTHERN.—Contract for grading the proposed cut-off from Columbia Falls, Mont., west to Jennings, 50 miles, has been let to Seims & Shields. The contract for building the bridges along the new line has been let to Porter Bros., of Spokane, Wash. Work will probably begin as soon as the snow is off the ground.

HAMILTON & COLLINGWOOD.—Application is being made at the current session of the Dominion Parliament to incorporate a company to build from Hamilton north to Collingwood, Ont., 90 miles. Clarke, Gowan, Bartlett & Bartlett, Windsor, Ont., are acting for the promoters.

ILLINOIS CENTRAL.—Surveys are reported in progress for a line from Jackson, Tenn., southeast via Henderson, through Chester and McNairy Counties, along the Tennessee River to Tuscumbia, Ala., 90 miles.

INTER-MOUNTAIN ELECTRIC.—The directors of this road have authorized a bond issue of $500,000 to build from Sunnyside, Cal., to Clovis.

INTERNATIONAL & GREAT NORTHERN.—It is reported that this company may abandon its proposed line between Houston and New Orleans by way of Beaumont, owing to the refusal of the Beaumont City Council to grant the necessary franchise for an entrance into the town. A new route from Spring, Texas, to a connection with the Texas & Pacific at Alexandria, La., is now being considered.

IOWA CENTRAL TRACTION.—This company has been incorporated in Ohio to build an electric line 28 miles long. F. T. Pomeroy, Cleveland, has been elected President; L. M. Coe, Vice-President, and L. M. Wolf, Secretary and Treasurer.

KANSAS CITY, MEXICO & ORIENT.—Contract is reported let for grading this line for a distance of 30 miles west from Minaca, Mexico, to David Shaw, Chihuahua, Mexico, and contract is also let for grading the second section of 30 miles east from Chihuahua to G. Webb, of Parral, Mexico. (See Construction Supplement.)

LAKE & ERIE.—See Railroad News.

LANCASTER & YORK FURNACE.—The Sennis Construction Co., of Philadelphia, has received the contract for building this electric road from Millersville, Pa., south to York Furnace, 10 miles. The company was incorporated in July, 1902. (Aug. 1, 1902, p. 616.)

LOUISVILLE & NASHVILLE.—This company is planning to build a branch line from Altoona, Ala., east to Attalla, 17 miles, where connection will be made with the Alabama Great Southern, and the Nashville, Chattanooga & St. Louis.

MANILA STREET RY.—A 50-year franchise for operating the street railroads and electric lighting and heating and power plants in Manila has been granted to J. G. White & Co. and Westinghouse, Church, Kerr & Co., both of New York city. According to the concession, 35 miles of street railroad will be built, which, together with the 15 miles of mule car lines which now exist in Manila, will make a total of 50 miles of street-car lines controlled and operated by the above companies.

MEXICAN CENTRAL.—It is reported that work will be resumed on the Manzanillo extension of this road, which is being built between Tuxpan and Colima, 45 miles. The recent severe eruption of the Mount Colima volcano interrupted work all along the line. (Oct. 17, 1902, p. 805.)

MEXICAN NATIONAL.—This company is reported to be making ready to change to standard gage the line from Saltillo south to San Luis Potosi, 225 miles.

MEXICAN ROADS.—Ramon Fernandez del Rio has been granted a concession by the Mexican Government to build a railroad from the station of San Vicente, on the Cuernavaca Division of the Mexican Central east to the San Francisco ranch in Pueblo County, where it will connect with the branch of the Mexican National.

A California company, represented by W. J. Johnson, has obtained a concession from the Mexican Government to build a railroad through the States of Campeche and Yucatan. It is stated that the company is prepared to begin work immediately.

The San Ildefonso Factory Co. has obtained a concession from the Mexican Government to build a railroad from the City of Mexico west to Tialnepantla, 15 miles, where the factory of this company is situated.

MILL CREEK & ADDISON.—A charter has been granted this company to build from Mill Creek, Randolph County, W. Va., southwest to Addison, 30 miles. The incorporators are W. H. Cardwell, E. W. Nealey, R. H. Avey, Jr., and Buchanan Schley, all of Hagerstown, Md.

NICOLA, KAMLOOPS & SIMILKANEEN COAL & RAILWAY CO.—Application will be made at the next session of the British Columbia Legislature for authority to build from Nicola Lake west to Spence's bridge, 40 miles, and from Nicola Lake southwest to Hope, 70 miles, and thence along the Fraser River to Chilliwack, B. C. Gowan, Kappele & McEroy, Vancouver, B. C., are acting for the promoters.

NORTHERN PACIFIC.—Surveys are reported finished for a new cut-off from Kirkland Junction, one mile west of Woodinville, Wash., south along the east shore of Lake Washington to Belt Line Junction, where connection will be made with the main line of the Northern Pacific between Seattle and Auburn. Contracts for this new line will probably be let in the near future.

OKLAHOMA SOUTHWESTERN.—This company has been chartered in Oklahoma to build through Custer, Day and Roger Mills Counties; capital, $600,000. John Overholt, Enid; Calvin Rosser, J. N. Cook and J. A. Mays, Elk City, are interested.

OZARK & SULPHUR MOUNTAIN TRACTION (ELECTRIC).—This company has been organized, with a capital of $600,000, to build an electric line from Harrison, Ark., northeast to Keener, Bellefonte and Sulphur Mountain, 20 miles. W. G. Gardner, Toledo, Ohio, is President; John J. Geghan, Harrison, Secretary, and James A. Flinn, C. M. Green, and others of Harrison, are directors.

PERE MARQUETTE.—This company has been incorporated in Indiana as a part of the Pere Marquette system, with a capital of $500,000, to build from New Buffalo, Mich., in a southerly direction through the counties of LaPorte and Porter in Indiana, to a point near Hammond, Ind., 45 miles. The principal stockholders in the new company are F. O. Prince, Boston; Newman Erb, New York City; James H. Simpson, Detroit, and others.

PHILADELPHIA & READING.—Contracts for 25 miles of the new third track to be built between Philadelphia and Reading have been let as follows: First section from Abrams to Bridgeport, contract let to Willauer & Co., Pottstown; second section, from Port Kennedy to Valley Forge, Kearns & Egan; third section, from Sanatoga to South Pottstown, Willauer & Co., Pottstown; fourth section, from Stowe, one-half mile northeast, Ryan & Kelly.

PITTSBURGH & LAKE ERIE.—Work on the double track between McKeesport and Fayette City, Pa., 35 miles, is in progress. This part of the road was built under the title of the McKeesport & Belle Vernon but was subsequently taken over by the Pittsburgh & Lake Erie, and is now known as the Youghiogheny Division. J. A. Atwood is Chief Engineer. (Oct. 24, p. 825.)

QUINCY & ILLINOIS WESTERN (ELECTRIC).—Contract has been let to the Bracey-Howard Construction Co., Chicago, Ill., to build this line from Quincy east to Beardstown, 120 miles, and north to Niota.

SELMA & CAHABA—Press reports state that work on this road will shortly be started. The proposed route is from Selma north to Birmingham, 60 miles. The line has been surveyed for some time but no building has yet been authorized. H. L. McKee, Meridian, Miss., is President.

SUSQUEHANNA & SOUTHERN (BUFFALO & SUSQUEHANNA).—Contracts are reported let to Mason, Hoge & Co., Frankfort, Ky., and to Frank Greco, for this new line which is building from Sinnemahoning, Pa., to Sykesville, 65 miles. N. E. Olmsted, Harrisburg, President. (See Construction Supplement.)

TEXAS ROADS.—The Sabine Tram Lumber Co. is making surveys for a line from Deweyville northwest, a distance of 35 miles, and from Orange east to Echo, six miles. Rights of way have already been secured.

UNION PACIFIC.—Contract has been awarded W. C. Bradbury & Co. for building the cut-off from Cheyenne east to Archer, Wyo., 10 miles. A contract has also been let to Kilpatrick Bros. to build a double track from Borie west to Buford, 20 miles. (March 13, p. 204.)

UNION SPRINGS & NORTHERN.—The stockholders of this company have authorized an issue of $1,000,000 in bonds, the proceeds of which are to pay for an extension from Fort Davis, Ala., southeast to Tallahassee, Fla.

WESTERN RHODE ISLAND.—Incorporation is being asked from the Rhode Island Legislature to build a new line from Coweset Bay, west through the towns of Apponaug and Crompton, and thence in a northerly direction via Anthony, Hope, North Scituate, Harmony and Chepacket to Burrillville, a total distance of about 30 miles. Geo. W. Prentice, Providence, R. I.; James S. Kenyon and Franklin P. Owen, Providence, R. I., are interested.

WISCONSIN ROADS.—Surveys are reported for a new line from Dunbar, Wis., terminus of the Dunbar & Wausaukee, in a westerly direction to a point where the Peshtigo River crosses Marinette and Forest Counties.

GENERAL RAILROAD NEWS.

ALBANY & HUDSON.—This company was incorporated on March 12, with a capital of $27,000,000. It has acquired the property and franchises of the Albany & Hudson Ry. & Power Co., which operates a third-rail electric line between Albany and Hudson, through Kinderhook, 50 miles. The directors are H. G. Runkle, C. L. Rossiter, A. M. Young, of New York; Horace Andrews, Cleveland, and others.

ARKANSAS SOUTHERN.—This road, which runs from Eldorado, Ark., to Winfield, La., 100 miles, has been sold to a St. Louis syndicate. Geo. W. Hunter has been elected President, and H. C. Brown, Vice-President, both of St. Louis.

ATCHISON, TOPEKA & SANTA FE.—This company has purchased the Eureka & Eel River and the California extension of this road, known as the Midland. Surveys are reported in progress for an extension of both these roads in a southerly direction.

ATLANTIC COAST LINE.—The following securities of the Atlantic Coast Line Co. were listed on March 12 by the New York Stock Exchange: $31,034,000 first consolidated mortgage 4 per cent. bonds, and $35,650,000 common stock.

BLACKWELL, ENID & SOUTHWESTERN (ST. L. & S. F.).—A mortgage has been filed by this company for $4,500,000 to cover the building of a line from Blackwell, Okla. T., to Vernon, Texas, 235 miles.

DES MOINES, MOUNT AYR & SOUTHERN (ELECTRIC).—The incorporators of this company have sold their interests to H. H. Baldridge, W. J. C. Kenyon and F. L. Loomis, of Omaha. The company was organized last fall for the purpose of building an electric line from Mount Ayr to Creston, Iowa. It is stated that the new owners will order surveys to be made at once and will commence work in the early part of the summer.

FORT WORTH & DENVER CITY.—A dividend of 4 per cent. has been declared on the preferred assented stock, payable out of the earnings of 1902. This road paid dividends of 2 per cent. in 1897, 1898 and 1901, but omitted dividends in 1899 and 1900.

IOWA & ST. LOUIS.—This line, which is being built from Centerville, Iowa, to St. Louis, has been purchased by the Chicago, Burlington & Quincy. The line has already been completed for a distance of 70 miles between Centerville, Iowa, and Novinger, Mo.

LAKE & ERIE.—This company has been formed by the consolidation of the Richland & Mahoning and the Ashland & Wooster roads, with a capital of $650,000. The new company has applied for a charter to build from Sandusky, Ohio, to Bellaire, and from Mansfield to a point in Mahoning County. It is reported that work will be begun as soon as the charter is obtained.

LEHIGH VALLEY.—Negotiations are reported to be under way for the consolidation, under the management of this company, of the Lehigh Valley Terminal, Easton & Amboy, Greenville & Hudson, Middlesex, Perth Amboy & Raritan and the Pittsburg Branch Companies. A bill for this consolidation is now before the New Jersey Legislature.

MUSCATINE NORTH & SOUTH.—Charles Howard, General Manager of this road, which extends from Muscatine, Iowa, south to Elrick Junction, 80 miles, has been appointed receiver of the property. The road was built two years ago as a feeder to the Iowa Central.

NEW YORK & PORTCHESTER (ELECTRIC).—The Appellate Division of the New York Supreme Court has handed down a decision confirming the action of the State Board of Railroad Commissioners in granting a certificate to the New York & Portchester. The application of the company was made in April, 1901, and it was opposed by the New York, New Haven & Hartford on the ground that the road was not a public necessity. The plan calls for a four-track electric road from the Harlem River, eight miles through the city of New York (Borough of the Bronx), to Pelham, New Rochelle and Larchmont, and thence to a terminus 1½ miles beyond Portchester, a total distance of about 25 miles.

NORTHERN PACIFIC.—This company is reported to have bought the Columbia Ry. & Navigation Co., which was the promoter of the Portage road projected along the Columbia River from The Dalles, Ore., to Columbus, Wash., 22 miles.

QUEBEC SOUTHERN.—This road was reported closed about two months ago. A strike occurred among the laborers working on the road and since that time the line has been lying idle. Several petitions have been forwarded to the Minister of Railroads and Canals urging the Government to assume control, but nothing definite has yet been done. The line runs from Noyan Junction north to Sorel, Que., 89 miles. (May 23, 1902, p. 386.)

SOUTHERN PACIFIC.—A circular has been sent out by Talbot J. Taylor & Co., New York city, soliciting proxies, to be used at the annual meeting of the Southern Pacific Company on April 8. This circular is in the interest of James R. Keene and a minority of the stockholders, who claim that the earnings have been unduly diverted to improvements, and that a dividend should be declared. A temporary injunction has been granted by Judge H. H. Lurton, of the United States Circuit Court in Kentucky, against the Southern Pacific, which, if confirmed, will prevent the voting at the coming meeting of the $90,000,000 of Southern Pacific stock, now held by the Union Pacific.

WESTERN PACIFIC.—Parties representing the San Francisco & Oakland Ry. & Ferry Co., and the Stockton & Beckwith Pass R. R., which were recently consolidated and incorporated under the above title, have purchased 76 acres of land in San Francisco at a cost of $1,000,000 from the Potrero Land & Water Co.